The Dock and Harbour Authority

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Editorial Comments

Rio de Janeiro.

For our leading article this month we turn to South America, in order to give our readers some account of Rio de Janeiro, capital and chief port of Brazil.

There are few harbours in the world to compare with the naturally spacious accommodation and scenic beauty of Rio. The Bay, opening out of the South Atlantic, has a navigable area of over 30 square miles, with a coastline, which, disregarding the smaller indentations, runs to something like 60 miles. It extends inland from the open sea for a distance of about 15 or 16 miles and its irregular width ranges from 7 miles, or less, to well over 10 miles. It is studded with charming islands, the largest of which is Governor's Island, and is remarkably well sheltered, being enclosed in undulating country with a background of mountain ranges. The entrance is flanked by two bold headlands, one a steep, conical mass, known as the Sugar Loaf, over 1,200-ft. in height, forming a conspicuous feature of the landscape. Another peak, more sharply edged, is Corcovada (Hunchback), rising to 2,300-ft. and overlooking the suburb, of Botafogo.

From the point of view of navigation, the entrance, about a mile in width, but relatively narrow as compared with the interior of the bay, is safe and convenient, having depths more than sufficient for present-day shipping. There is practically no bar and the internal anchorage in adequate depth of water is all that can be desired.

The name of the bay is rather curious. Rio, of course, means river and Rio de Janeiro, January River, having been bestowed by reason of its discovery on the first day of a certain January, when it was imagined to be the mouth of some large river. The discoverer and date of discovery are alternatively alleged to be André Gonçalves in 1502 or Alphonso de Souza in 1531—both of them Portuguese navigators. The city, which was founded in 1566, was dedicated to St. Sebastian and its full name is Sao Sebastiao do Rio de Janeiro.

With so many natural advantages it is not surprising that the city has flourished exceedingly and, in 1822, it was made the capital of the Brazilian Empire. It has many attractive features: wide thoroughfares and magnificent buildings. The Avenida Beira-Mar is a beautiful suburban boulevard stretching for miles round Botafogo Bay, which constitutes an inner embayment.

For particulars of the port and its trade, we must refer our readers to the article in the following pages. We have already allowed ourselves to stray rather far in dwelling on the natural facilities of the harbour, but the subject is an attractive one and excuses a little latitude. There is every reason to anticipate a prosperous future for the great Brazilian port.

The Air Raids on London Docks.

The air raids within recent weeks on the docks and warehouses of the Port of London Authority have been the subject of official announcements and of descriptive accounts in the daily press, so that there is no occasion to refer to them further in detail. They have been carried out with the customary ruthlessness and savagery which characterise the Nazi brutes in all their deeds, and without the slightest regard for the civilian population, not only in the immediate vicinity of a legitimate military objective, the docks, but over the whole of the metropolis. It is not our province to comment on the ethical and political aspects of the matter, we can only express satisfaction that the damage inflicted has not come up to the enemy's expectations and that the Minister of Food has been able to issue a reassuring statement about the effect on the supply of foodstuffs, which happened at the time to be stored in the dock sheds and warehouses. He added a timely admonition to traders to remove their consignments as speedily as possible from an area which is inevitably beset with serious dangers. By so doing, they will, at the same time, be assisting to reduce the liability to congestion at the quays, which it cannot too often be pointed out, is a source of great trouble and anxiety to port officials.

The Port of Glasgow Inquiry.

Too late for the inclusion of a reference in our last issue, it was announced towards the end of August that the Minister of Transport, after consultation with the Minister of Labour, had appointed a Committee of Inquiry, under the chairmanship of Lord Patrick, one of the Senators of H.M. College of Justice in Scotland, with the following terms of reference: " To consider the position at Glasgow Docks in all its aspects and to make recommendations thereon with a view to the most efficient working of the port during the war."

The committee was completed by the nomination of Mr. Reginald P. Biddle, Docks and Marine Manager of the Southern Railway at Southampton, and Mr. George W. Thompson, of the Association of Engineering and Shipbuilding Draughtsmen, Member of the General Council of the T.U.C. and its representative on the National Joint Advisory Council.

It is not to be inferred, we understand, from the step taken by the Ministry of Transport that there is any special ground for criticism of the present management of the port, but simply an endeavour to ensure that the best possible use is made of the accommodation and facilities in the exceptional circumstances created by the war. The important part played by the war-time organisation of the Port Emergency Committee is a matter of local common knowledge and as fresh problems present themselves from time to time, calling for special consideration, it was felt that no effort should be spared to maintain its full efficiency.

Up to the time of writing, no information has been received as to the findings of the Committee and their recommendations are awaited with interest, though it is by no means certain that they will be given publicity. It may be added that until recently Glasgow was the only port in the United Kingdom where the Dockers' Registration Scheme was not in operation; the scheme, however, is now in force.

Aden.

With the loss of Berbera and Zeila in British Somaliland, the Port of Aden on the opposite side of the Gulf of Aden has acquired an added importance, since it is now the sole remaining point of support for British forces operating in the Straits of Bab-el-Mandeb and of protection for British shipping passing to and from the Red Sea. Indeed, Aden in the east occupies a position of military strategical importance equivalent to that of Gibraltar at the western end of the Mediterranean and steps have been taken to fortify it accordingly. It possesses physical characteristics of a similar kind. The volcanic outcrop in the barren and desolate peninsula rises to a height of over seventeen hundred feet and the rocky promontory, like that of Gibraltar, has been honeycombed with galleries and tunnels, so that it can offer effective and prolonged resistance to attack from sea or land. There is moreover a large air base centred on the low-lying ground adjacent to the mainland.

Editorial Comments—continued

From a commercial standpoint, Aden is valuable as a port of call for coaling and oil fuelling; also for supplies of fresh water. The local ground water, indeed, is brackish, but by means of the important distilling plants which have been installed, fresh water of excellent quality is available for shipping, though it must be admitted that it is rather expensive to purchase.

As regards harbour accommodation, the inner harbour on the western side of the town, formerly known as Aden Backbay, has a dredged depth of 29-ft. and is capable of affording safe anchorage to a large number of vessels.

The area of the colony is 75 square miles and there is a local population of about 600,000, but the Protectorate along the Arabian coast extends to 112,000 sq. miles. There is a small island, Perim, at the Western extremity, which is 5 sq. miles in area. The Kuria Muria islands, lying at a distance of nearly 800 miles away, off the Coast of Oman, are an appanage of Aden, which, formerly administered by the Government of India, became a Crown Colony as recently as 1937.

Much importance attaches to the possession of Aden for it commands the approach to the Red Sea from the East and so the Southern entrance of the Suez Canal. While it remains in British hands it will be a grave menace to Italian projects in north-eastern Africa.

" Bottle-Neck " Ports.

The statement, printed on another page of this issue, which the Minister of Transport has judged it expedient to circulate respecting the functions of Port Emergency Committees, rightly emphasises the necessity for suppressing " bottle-neck " conditions, which obstruct the free flow of traffic and foster congestion. Unfortunately, the defect is characteristic of a number of British ports and during the last European war there were flagrant examples of the evils which it engenders. Readers of this Journal who passed through the port traffic ordeal of the closing years of the war and even later, will recall the conditions under which shipping was held up for weeks at a time, unable to find berths at which to discharge their cargoes.

That the evil still persists is undoubtedly beyond question. Only the other day, a member of an important port trust in the North wrote to the press to point out the danger threatening his own port and urging the provision of additional means of clearance in the shape of canal transport. In this Journal the same expedient has been advocated time and again, and it is regrettable that relatively so little has been done to organise the canal and waterway systems of the country to enable them to cope with the volume of traffic which, in certain localities, exceeds the capacity of the road and rail services.

It is all very well to urge traders and port officials to expedite the clearance of quays and transit sheds, but unless adequate facilities are available for the purpose, such advice is at once nugatory and futile. And it is rather late in the day now to initiate measures which should have been taken some time ago in anticipation of the need which has arisen.

The Use of Uncovered Wagons at Ports.

As a further measure for the elimination of tendencies to quayside congestion, the Minister of Transport has given instructions that railway companies shall convey goods in open railway wagons, if neither covered wagons nor sheets are available for the urgent dispatch of cargoes from the quays. Sheets for covering wagons are made from flax and some of the usual sources of supply are no longer in operation, so that the stocks on hand may be insufficient for requirements, especially as under present conditions demands are greatly increased. The instructions will, however, only become operative when a Port Emergency Committee serves notice on a railway company that it is necessary, in order to clear the port, for certain traffic to be despatched immediately. Notice will only be served when there is real danger of acute congestion, and not in cases where there is merely a temporary intermittent shortage. Goods in wagons will not in future be double-sheeted. As a corollary to the above instructions, an Order has been made under Regulation 56 of the Defence (General) Regulations, entitled " The Railways (Sheeting of Traffic) Order, 1940," relieving the railway companies from liability for damage to merchandise carried unsheeted in accordance with the instructions issued by the Ministry.

Sand Travel on the Coromandel Coast.

The article which we publish in this month's issue on the Harbours and Ports of the Circar and Coromandel Coasts of South India touches upon a problem of no little importance to harbour engineers and others, who have to deal with the construction and maintenance of harbours in sandy localities. The outstanding case of this kind is, of course, the Port of Madras, which the late Sir Francis Spring, one of the most capable and resourceful chairmen of that body, once described as " a gauntlet flung in the face of Nature." Lying within a flat, sandy shore on which the ocean surf has beat for centuries of time, the harbour from the very moment of its construction has had to contend with a menace which threatened the extinction of its utility and service. The rapid accumulation of sand to the south of the southern breakwater caused the coastline to move forward to its outer extremity almost simultaneously with its completion, and, thereafter, the eastward entrance silted up at the rate of 1 foot per annum. The trouble was first countered by dredging, but eventually the plan was adopted of substituting a northern entrance under cover of a sheltering arm or breakwater. This allowed the sand to drift northwards past the former entrance, which was closed.

Latterly, it has been realised that this was only a palliative and not a cure for the evil. As a further counter-measure, a new spur was started in prolongation of the southern breakwater and carried into deeper water, which delayed the obstructive effect of the accumulation. The time has inevitably arrived however, when the shoaling has become too pronounced to be allowed to continue and the Madras Harbour Board are apparently contemplating a reversion to the former policy of systematic dredging. According to a report of the proceedings of the Board, sanction has been given, subject to the approval of the Government of India, for the expenditure of Rs. 1,50,000 on the provision of equipment for the removal of sand, as an experimental measure, from outside the eastern arm of the harbour and for its disposal at sea.

Whether this scheme is economically sound is a matter of dispute. Dredging expenditure is bound to be recurrent, and in the long run, the annual expenditure incurred may become considerable, without achieving any permanent benefit. The alternative is to extend the new spur into still deeper water and so gain a respite in time until shoaling once more becomes acute. As the depth of the water increases outwards, it will tend to prolong the period of benefit. Which of the two schemes is likely to be the more economical is difficult to say without much fuller information than is available, but it would seem that the port authority is faced with a problem, for which perhaps no complete and permanent solution can be found.

The Port of Alexandria and the War.

The Report for the year 1939, recently issued by the chairman of the British Chamber of Commerce of Egypt, shows the effect of the early stages of the war on the port of Alexandria. The total value of imports into Egypt during the year was less by nearly £E3 millions than in 1938. On the other hand, the value of exports increased by about £E4¾ millions. The bulk of these variations relate, of course, to the trade of the leading Egyptian port.

The number of ships which entered the port of Alexandria during 1939 was 2,251, or about ten per cent. less than the number in 1938, and the total tonnage handled was 5,267,000 as against 5,621,000 in the previous year. The number of British ships was 527, as compared with 561, but the tonnage, viz., 1,186,000 was almost identically the same as before. As regards the four months, September to December, during which hostilities were in progress, the figures of total tonnage handled were 1,232,000 as against 1,965,000, this difference being due of course to the slowing down of shipping movements and to other consequences of the change from peace to war-time conditions.

As already announced in a previous issue of this Journal, considerable improvements in the accommodation and facilities of the port are in contemplation. The Egyptian Minister of Communications recently laid before the Chamber of Deputies a programme, which included the deepening of the main channel entrance to the harbour to a depth of 42 feet, the construction of a new basin for the petroleum trade, a certain amount of additional quayage for general purposes, and the building of a dry dock for large vessels. These undertakings, which will involve an outlay of some three millions sterling, will be spread over a period of from five to ten years. Meanwhile, on account of the war, the whole project is in abeyance until the situation improves.

Thames Ferry Service.

In consequence of the congestion on certain of the road, and underground rail services within the metropolitan area, it has been found expedient to revert to a form of water transport which at one time within the present century was quite an ordinary and even attractive feature, and was only discontinued because it was not successful financially. A passenger boat service has been introduced on the Thames from the London and North-Eastern Railway Pier at North Woolwich to Westminster, calling *en route* at Brunswick (for East India Docks), Greenwich, West India Dock (Wapping) Tunnel, Cherry Garden (Bermondsey) and Tower Piers. The service starts daily at 6 a.m. and continues at half-hourly intervals until about 6 p.m.

It cannot be claimed, of course, that ferry transit is as speedy as other forms of locomotion, but the alternative means of travel is very useful and provides contact with both banks of the river.

Rio de Janeiro

The Great Brazilian Sea-Port

By "HELIOS."

ALTHOUGH Brazil is an enormous country (with an area of over 2,500,000 square miles), comparable with the United States of America or the whole of Europe, the major part of it consists of the basin of the Amazon, which is chiefly a tropical jungle, producing little but wild rubber, fruit and timber, and rather scantily occupied by somewhat intractable aborigines.

To the South-east of this area, lie the Brazilian Highlands, draining either directly to the sea or inland to the great Plate River system through the States of Paraguay, Argentina and Uruguay. These highlands rise to a general height of over 3,000-ft. near the coast (the Serra de Mar) and it is on their slopes that Brazil has developed most highly. Close to the Tropic of Capricorn the conditions are best. The two major ports of Brazil, Rio de Janeiro and Santos, are situated here within about 200 miles of each other. Santos is the great coffee port (coffee being Brazil's major export, the annual production amounting to about 1½ million tons) and Rio the general port of the country with a population of 1,800,000.

Botafogo Bay, Rio de Janeiro.

The site of Rio was discovered by the Portuguese in 1502 and was first settled by Europeans in about 1550, but it was not until the early years of the nineteenth century when, like other South American States, Brazil became independent, that Rio began to be of international importance. The growing demands of Europe for the agricultural and pastoral products of the New World in exchange for manufactured goods, railway material, machinery, etc., have operated in the same manner in Brazil, as in the U.S.A., Canada, and Argentina, to produce rapid development. The pace has, however, been slower there than in the other countries, owing to the tropical conditions of the Brazilian alluvial areas, which render large parts of them unsuitable for the growing of grain or grass, forming the basis of all human food supply. There are, however, considerable areas of higher, cooler land, so that Brazil now exports an appreciable amount of hides, meat and grain. It is, however, in tropical products (coffee, cocoa, sugar, tobacco, rubber, cotton, vegetable oils, fruits) that she specially excels. In recent years, as elsewhere, she has begun to to manufacture and, in fact, her exports were until recently in excess of her imports, showing that she has been repaying Europe (and the U.S.A.) for some of the capital goods which enabled her to develop. Incidentally, this is a danger signal for the future of the European export trade to Brazil. In minerals, there are good prospects. Iron ore is being worked near Rio (steel production about 80,000 tons per annum) and there is coal (nearly one million tons per annum being produced) in the extreme south of Brazil. Manganese is an important product, while those useless things, gold and diamonds, rank as valuable exports. Hydro-electric power plants have been developed in the Rio area.

The foreign investment in Brazil is stated to be of the order of £500,000,000, of which about £60,000,000 is Government debt. The foreign trade of Brazil in 1938 was about £72,000,000, half in exports and half in imports, but has amounted to two-and-a-half times this figure in earlier years. It is distributed mainly between the U.S.A., Great Britain and Germany.

Topography

Rio is situated in latitude 22° 54′ S and Longitude 43° 10′ W, on the west side of the entrance to Guanabara Bay, which is one of the finest natural harbours in the world, as well as being very beautiful. On the opposite side of the entrance is Niteroi, the capital of the "State" of Rio de Janeiro, the city of the latter name being the capital of the republic of Brazil.

The Bay is nearly 16 miles long and has a maximum width of 15 miles and contains several very picturesque islands. The entrance is about one mile wide, with a channel depth exceeding 80-ft. The Bay is as much as 160-ft. deep in places, but the anchorage area has a depth of from 65-ft. to 80-ft. The navigable area is 30 sq. miles.

The port itself is approached by a route just inside the west of the entrance to the Bay and there is a depth of 33-ft. in this passage over a width of nearly 500-ft., with a turning space about 800-ft. wide. The entrance leads right up to the quayside wharves.

Meteorology, etc.

The average temperature is about 77° F., the mean January value being 80° and the mean July value 65°, usual range from 50° F. to 100° F. The annual rainfall is about 44-in.

In the trade wind area in the Atlantic close by, the wind is S.E. practically all the year round, but at Rio the prevalent wind in January is E.N.E., and in July East. The Bay is so large that very appreciable wave action occurs in it, but the port is well sheltered by Governador Island and the Niteroi Peninsula. Wind velocities up to 82-ft. per second have been recorded.

The spring tide range is only about 8-ft., and the "establishment" is 56h. 42m. after new or full moon.

Accommodation

The present berthing facilities consist of over two miles of wharves along the shore just north of the city. A further two-thirds of a mile is under construction, and there is a large project (shown on plan) for piers and wharves in the Ponta da Caju area, providing over 6 miles of additional berthage.

A special pier for very deep draught ships is also proposed close to the entrance. Rio has already been visited by the "Normandie" and the "Rex" (the latter has been berthed alongside the quay).

The depths alongside the quays are given as follows:—

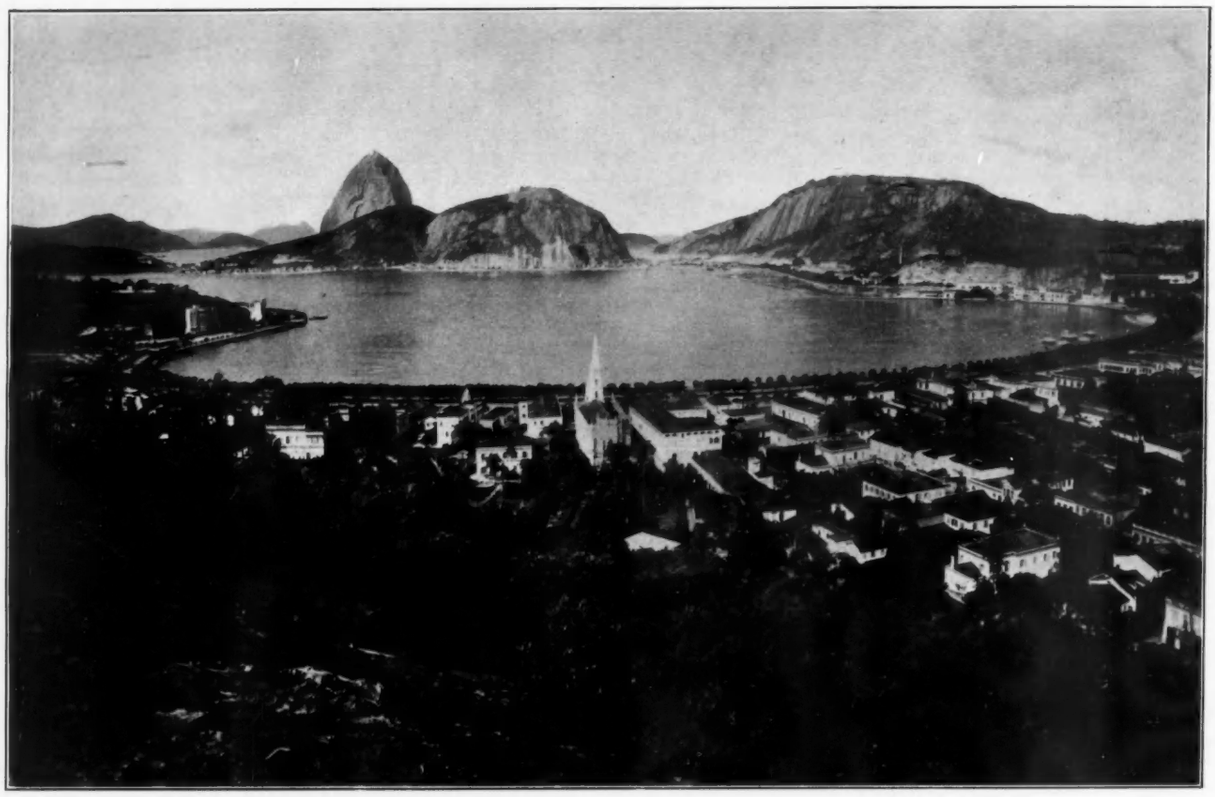
1,300 linear feet with 34 feet depth
2,600 linear feet with 32 feet depth
4,900 linear feet with 30 feet depth
6,600 linear feet with 25 feet depth

The wharf deck is nearly 12-ft. above tidal zero. There are three railway tracks on the quay front, with centres respectively about 15, 32 and 47-ft. from the water's edge and the front wall of the transit sheds is 82-ft. from that verge.

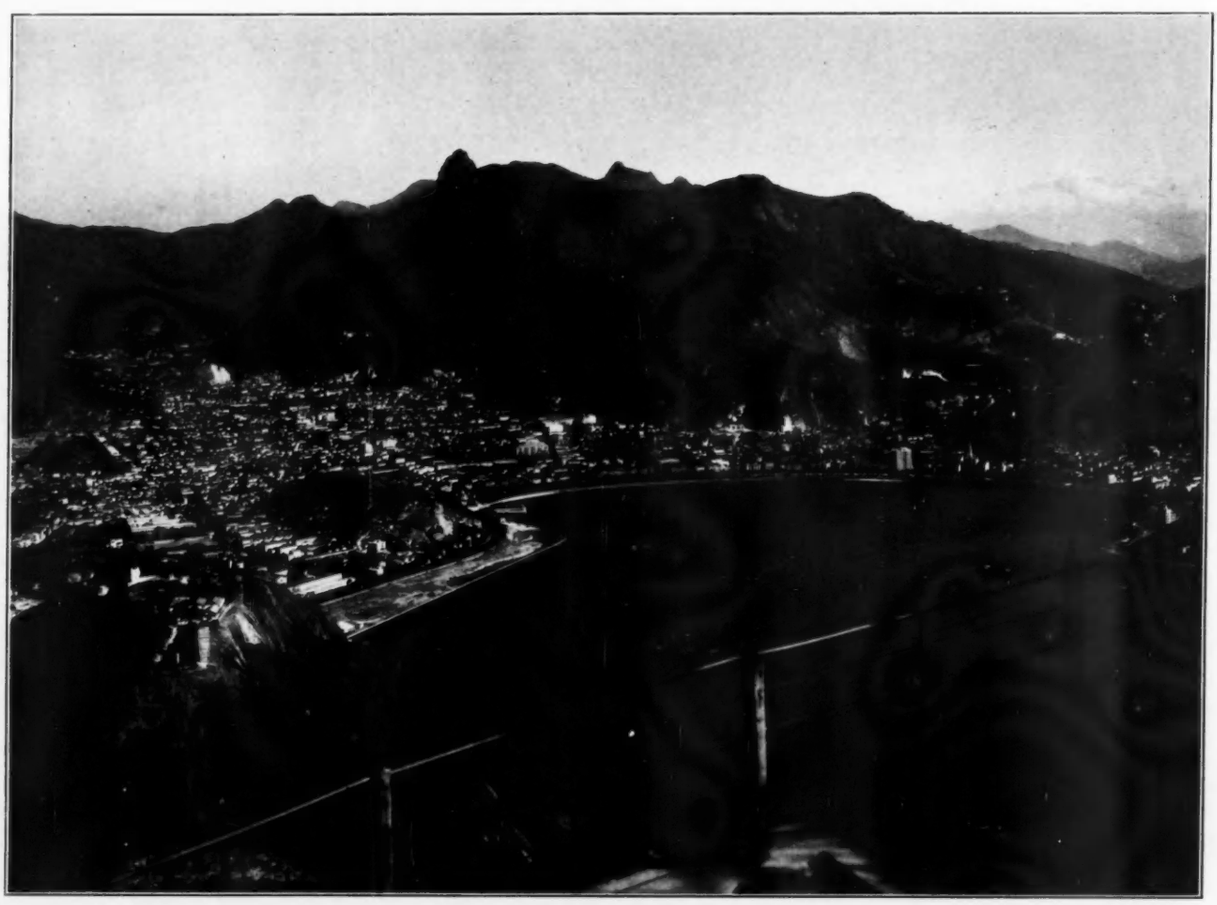
The sheds are raised on a loading platform about 2½-ft. above the quay deck. This platform extends to 33-ft. quaywards in front of the sheds and about 10½-ft. behind them. The sheds are about 330-ft. long by about 115-ft. wide and about 26-ft. high. Two 50-ft. roads run behind the transit sheds with 10-ft. wide foot walks. (Avenue Rodrigues Alves).

There are 19 transit sheds with a floor area of over	700,000 sq. ft.
Six warehouses with	400,000 sq. ft.
Yard space covering	350,000 sq. ft.
And open storage for	475,000 sq. ft.

The Port of Rio de Janeiro

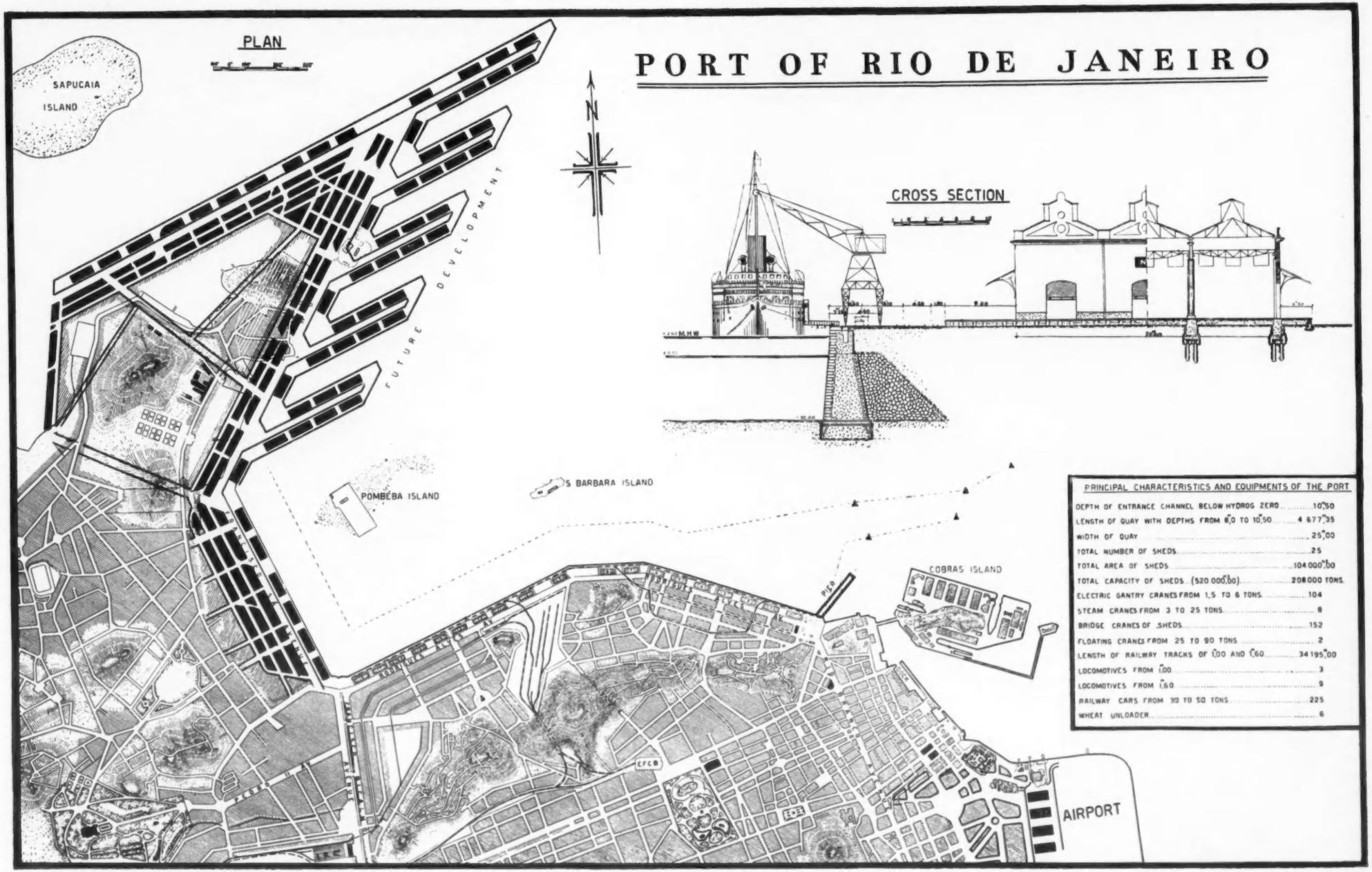


Botafogo Bay and Promenade, Rio de Janeiro, The Sugar Loaf Mountain in background.



Beach at entrance to Harbour at Rio de Janeiro.

PORT OF RIO DE JANEIRO



PRINCIPAL CHARACTERISTICS AND EQUIPMENTS OF THE PORT	
DEPTH OF ENTRANCE CHANNEL BELOW HYDROG ZERO	10,50
LENGTH OF QUAY WITH DEPTHS FROM 6,0 TO 10,50	4 677,35
WIDTH OF QUAY	25,00
TOTAL NUMBER OF SHEDS	25
TOTAL AREA OF SHEDS	104 000,00
TOTAL CAPACITY OF SHEDS (520 000,00)	208 000 TONS
ELECTRIC GANTRY CRANES FROM 1,5 TO 6 TONS	104
STEAM CRANES FROM 3 TO 25 TONS	8
BRIDGE CRANES OF SHEDS	152
FLOATING CRANES FROM 25 TO 90 TONS	2
LENGTH OF RAILWAY TRACKS OF 1,00 AND 1,60	34 195,00
LOCOMOTIVES FROM 1,00	3
LOCOMOTIVES FROM 1,60	9
RAILWAY CARS FROM 10 TO 50 TONS	225
WHEAT UNLOADER	6

Rio de Janeiro—continued

There are about 10 miles of rail track in the quay area and a further 12 miles in the port zone. These connect to the railway system extending throughout eastern and southern Brazil.

Quayside Plant

There are 112 electric wharf cranes on 15-ft. tracks, 8 steam cranes, 152 travelling bridges, 182 port railway trucks (mostly 30 tons), 12 port locomotives, 2 floating cranes (25 and 90-ton lifts respectively), 6 mechanical wheat unloaders of 400 tons per hour capacity and sundry minor items. Seven dry docks, the largest of which is 41½-ft. by 107-ft. by 42-ft. over sill; one floating dock (500-ft. over keel blocks) and 3 patent slips.

Management

The port belongs to the Federal Government and its operation is ruled by decrees issued in 1938. In accordance with these decrees, the industrial and commercial operation is in charge of an autonomous commission, consisting of a Supervisor and a Manager appointed by the President of the Republic and of an Administration Council of seven members, three chosen by the Government and four appointed by the Rio Chamber of Commerce, the local Industrial Federation, the Transatlantic Navigation Centre and the Syndicate of National Shipowners. The Government members are respectively traffic, port and administrative experts.

Trade and Traffic

The following shipping and trade figures are given for 1937:—

Number of Foreign ships entered	1,974
Foreign ships register tons	9,435,094
Number of Coastwise ships entered	2,030
Coastwise ships register tons	2,010,251
Merchandise imported from abroad	1,534,939
Merchandise imported from coast	705,809
Merchandise exported to abroad	722,811
Merchandise exported to coast	342,226

Since 1905, the number of ships has almost doubled and the tonnage nearly trebled.

Financial

The currency unit of Brazil is the " milreis " (written 1$000, not to be confused with the U.S.A. Dollar $1.000). In recent times the value of the milreis has been about equivalent to 3½d., although its " par " value is supposed to be $0.33 U.S.A. currency.

In the Brazilian Government publication, " Ports and Navigation, Brazil, 1940," the following figures are stated in connection with Rio de Janeiro for the year 1937:—

Exploitation receipts	30,878,830 milreis
Exploitation expenses	481,873 milreis
Net income	7,025,098 milreis
Ten per cent. surtax	41,851,995 milreis

Port Charges

The following charges are listed:—

Lighthouse tax, 1,600 milreis for steamers over 700 tons, payable at first two ports of call in Brazil.

Pratique for foreign steamer, 20 milreis.

Customs freight tax, 0.4% ad valorem on exports

Charity tax, 12 milreis per mast.

Leave permit, 10 milreis (priority 290 milreis, outside hours 465 milreis).

Use of Port, 1$300 per ton handled.

Berthing, $700 per metre per day.

Berthing (lighters), $500 per metre per day.

Handling imports, $004 to $015 per kilogram, according to total weight of package.

Handling exports, $003 to $012.

Warehousing imports, $003 per kg. first month, $004 subsequent month.

Warehousing exports, $005 per kg. first month, $003 subsequent month.

Special rates for inflammables.

Loading to or from railcars, $004 to $006 per kg.

Use of cranes (up to 6 tons), 1 milreis per ton, with minimum charge of 20 milreis per hour.

Use of hand trucks, 15 milreis per day.

Water, 1$200 per cubic metre.

Pilotage service is official and charge is based on tonnage.

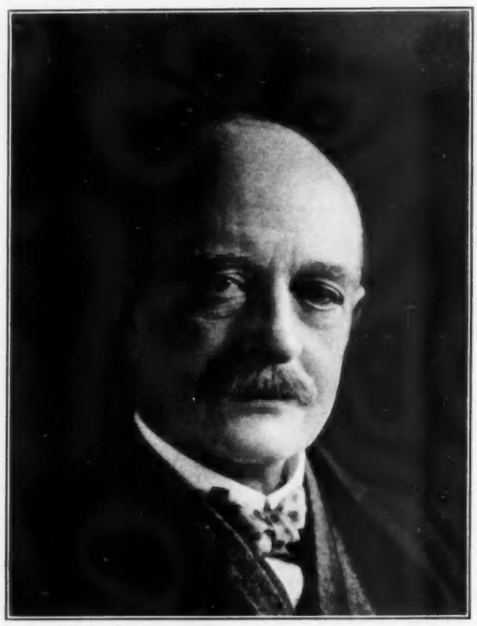
Shipping

No less than 53 foreign shipping companies have vessels calling at Brazilian ports; of these 8 are British. Rio is a terminus for only a few lines, most vessels from Europe going on to Buenos Aires. There is one Brazilian company (Lloyd Brasileiro) with vessels plying to foreign ports (New York, Hamburg) and there are eleven Brazilian companies operating coastal services.

Notable Port Personalities

III.—Mr. Dennis Ross-Johnson, C.B.E., V.D., M.Inst.T.

Mr. Dennis Ross-Johnson, formerly General Manager and Secretary of the Port of Bristol Authority, was born in England on the 20th July, 1860, and was taken to South Africa at an early age, receiving his education first at St. Andrew's College, Grahamstown, and later on returning to England, at University College School, London.



Mr. DENNIS ROSS-JOHNSON, C.B.E., V.D., M.Inst.T.

After leaving school, while on a visit to India, he was offered the post of Personal Confidential Clerk to Mr. Arthur Saunders, then Agent and Manager to the Madras Railway Company. This led to continuous service with the Company for 28 years, during which he passed through the grades of Locomotive Accountant, General Storekeeper, Assistant Agent and Manager, Deputy Traffic Manager, finally attaining the position of General Traffic Manager, which he occupied from 1900 to 1907.

In 1907, the Indian Railways, some of which are company-owned and others state-owned, resolved to establish a permanent body for dealing with questions of common interest; in effect, a combination of the functions in England of the Railway Companies' Association and the Railway Clearing House. Mr. Ross-Johnson was given the task of organising it, as first Secretary of the Indian Railway Conference Association, a post which he held for four years, until his appointment at the end of 1911 as General Manager and Secretary of the Port of Bristol Authority. During the 2½ years preceding the first European War, he was enabled to prepare the port for an important part in the service of the country, and during the conflict he served on many committees, both local and national. For these services he was awarded the distinction of Commander of the Order of the British Empire.

Mr. Ross-Johnson has frequently given evidence for his Authority in connection with Parliamentary Bills, before the Railway Rates Tribunal, and in other public enquiries. Subsequent to his retirement in 1928, he has frequently given advice and evidence for other Authorities.

He was for some years a Member of Council and later a Vice-President of the Institute of Transport. He is the author of " Modern Dock Operation," which has been adopted as a text-book for the examinations of the Institute of Transport; an article on " Port Operation " in the Encyclopædia Britannica; papers in the Institute Journal and articles in the technical press.

Cape Town New Harbour Scheme.

The contract period, terminating July, 1941, for the completion of the new harbour at Cape Town is to be extended in consequence of the Dutch contractors having been authorised to undertake additional work, including the reclamation of an area in the sea in the vicinity of the new graving dock site and around the yacht basin. As to original quantities of material for the reclamation of the foreshore will also be exceeded, it is unlikely that the project will be completed in its entirety before the end of next year.

Harbours and Ports of the Circar and Coromandel Coasts of South India

A Survey of Coastal Developments

By J. M. LACEY, M.Inst.C.E.*

Physical

THE general features of the Coromandel Coast, which extends from Point Calimere to the mouth of the Kistna River (diagram No. 1) are those of a gently undulating plain, sloping gradually from the Eastern Ghats to the sea. The strong monsoons, and the violent currents which sweep along the coast have thrown up ridges of sand along the coast rising in places to a considerable height. The small extent and the shortness of the deltas of the large rivers, discharging on this length of coast into the Bay of Bengal, when considered with regard to the length and the drainage area of their basins, and the general even width of the alluvial belt along the coast, seem to point to the existence in former times of alluvial land considerably eastward of the present coast line.

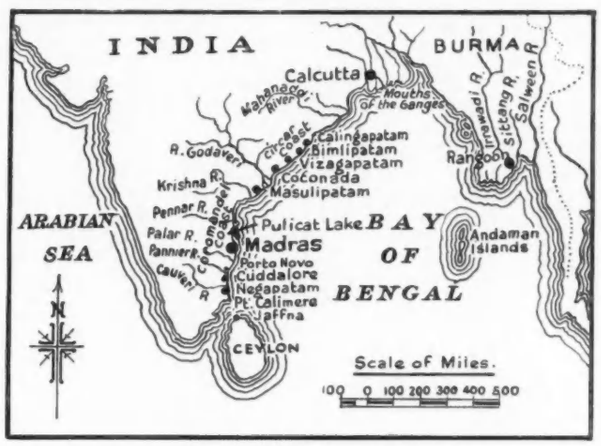


Fig. 1. Indian Coast Ports.

On the Circar Coast north of the mouth of the Kistna River, the coast line tends in a North-easterly direction. The deltas of the Godaveri and the Kistna Rivers are slowly extending seawards, their progress being checked by the powerful currents along the coast. The coast line abreast these two deltas is shallow. North of the Godaveri delta, along the shore, lie a series of salt and sandy swamps, but the coast line itself is broken by a number of bold headlands and beacons, which act as groynes to protect the land against encroachment of the sea.

Rain Fall

The seasons may be divided into—

(i) The Dry period—Cold weather season January, February and March. Hot weather season April and May.

(ii) Wet period—South-west monsoon, June to September; North-east monsoon, October to December.

The South-west monsoon current sets in the Bay of Bengal during the first fortnight in June, and passing the Coromandel Coast to which it furnishes an occasional shower, crosses the coast line North of the Kistna River, above which the rain fall is heavier. In September the force of the monsoon begins to decline, and after the middle of the month it ceases to carry rain to the greater part of North India. The monsoon begins to recurve in October, and a copious rain fall is discharged on the Coromandel Coast, and on the plains of the Carnatie. The rains last till December, moving southwards with the declining year.

Cyclones in the Bay of Bengal are usually generated during the changes in the monsoons. During the South-west monsoon they are rare except at the head of the Bay of Bengal. Occasionally cyclones develop in May. In October as the South-west monsoon gives way to the North-east monsoon, cyclones of very great intensity form in the Bay of Bengal and are propagated West or North-westward, sometimes curving to the North-west. The most destructive storms which visit the Circar and the Coromandel Coast are generally formed to the South of the Andaman Islands (fig. 1) and cross the Bay of Bengal in a North-westerly direction.

Tides

The vast tidal wave from the Southern Ocean is propagated up the Bay of Bengal to the mouth of the Ganges River. Owing to the configuration of the Bay, and the depth of the sea bottom, the range of tide increases with the latitude. At Negapatam the usual range at springs is 3-ft. At Madras the maximum range of tide in a year is nearly 5-ft. The usual range at springs is 3-ft. 5-in. At Vizagapatam the range of tide is 5-ft. 9-in. The tidal range at ordinary springs varies from 9½-ft. to 11-ft. at different places in front of the mouths of the Ganges River.

The tides in the Bay of Bengal are largely affected by diurnal inequality of both time and height. The datum of the charts of the Bay where the diurnal inequality is considerable is the level of "Indian Spring Low Water."

Surf

The Coast of South-east India from Gangam to Point Calimere is lined with a sandy beach, and owing to the sudden shelving shore there is always a surf along the coast. The surf rolling in upon the coast during both monsoons renders it hazardous and imprudent to land at any time in a ship's boat. Along the whole stretch of this coast, the country or "Masula" surf boat is peculiarly constructed to pass the surf; being built without timbers, with its planks sewed together, it bends to the force of the surf, and is easily repaired. When it blows fresh with a strong current, the surf is dangerous even to these boats.

Movement of Sand along the Coast

An enormous quantity of sand is moved along the coast, the direction of movement corresponding to the general direction and force of the waves. The movement is greatest near the shore and diminishes as the depth increases. The sand is arrested by any projection from the shore, the further side deprived of its protecting margin of travelling sand is eroded. Observations at Madras show the coast line to advance during the South-west monsoon. There is a tendency for the North-east monsoon to tear down the beaches and to deposit the sand slightly south-east of its former position, and within 800-ft. of the beach.

Ports

The administration of the major ports of Madras and Vizagapatam were taken over by the Government of India in 1937 and 1930 respectively. The minor ports are administered by the Provincial Government of Madras.

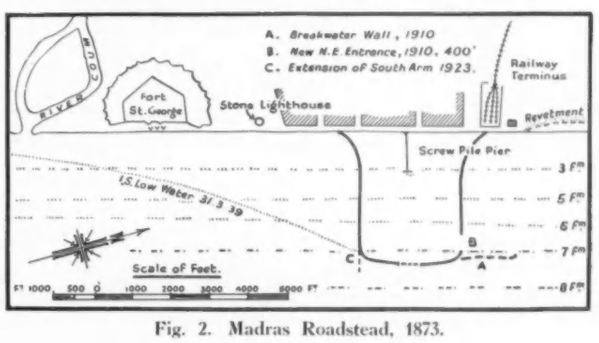


Fig. 2. Madras Roadstead, 1873.

West of Point Calimere (fig. 1) the coast consists of mud flats covered with mangrove bushes, and is flooded during high spring water. Depths of less than 3 fathoms extend from 3 to 4 miles off coast, getting deeper towards Point Calimere. The trade and importance of Point Calimere has been receiving consideration the last few years, and representations are being made urging that Point Calimere and Jaffna in Ceylon be the main Indo-Ceylon route instead of the Rameswaram Island route.

Ports north of Point Calimere along the Coromandel Coast, ships can come as close as ¾ to 1½ miles from the coast. In the open roadstead no vessel, large or small, anchors closer than this distance on account of the heavy ground swell which tends to drive the vessel on to the beach.

*Formerly of the Indian Public Works Department and sometime member of Madras Port Trust.

Harbours and Ports of the Coasts of South India—continued

The more important ports on the East Coast of South India are:—

Negapatam

An open roadstead with a depth of 5 to 5½ fathoms, soft ground 1½ to 2 miles from the shore, at the mouth of a small tidal river, which enables lighters to pass into a small harbour, and discharge on to jetties. Anchorage over sand and mud, depth shoals gradually towards the shore. In heavy weather a short broken sea sets up and it is inadvisable to anchor in depths of less than 5 fathoms. The chief exports are ground nuts to Europe and piece goods to the Straits Settlements. In the fiscal year 1937-38, 58,807 passengers sailed chiefly to the Straits Settlement and 29,519 arrived.

Imports valued at rupees	6,001,994
Exports valued at rupees	12,391,071

A rupee is valued at 1s. 6d.

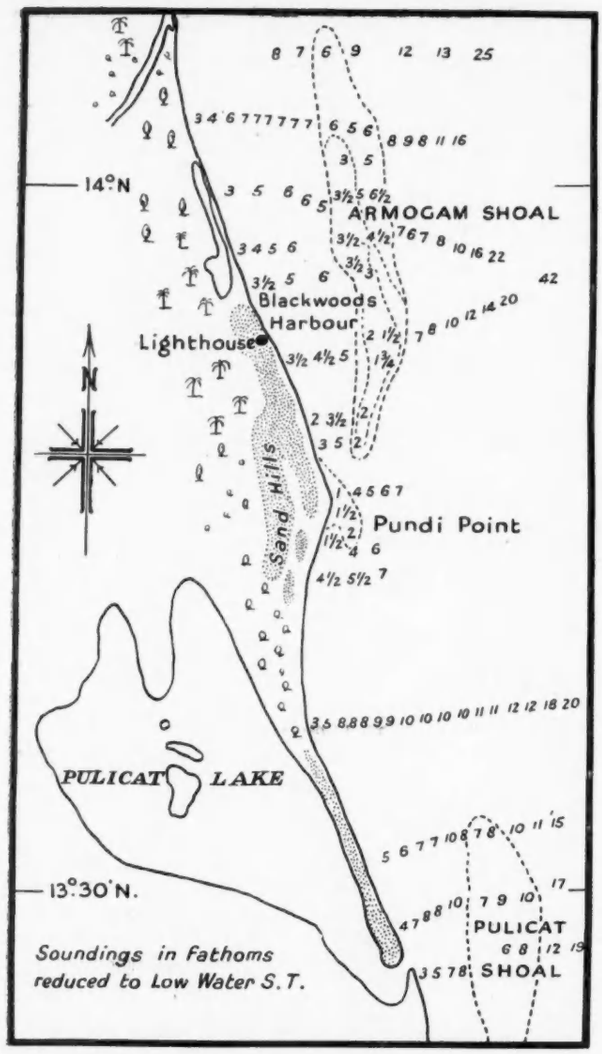


Fig. 3. Chart of Armogam and Pulicat Shoals, 1848.

Negapatam is the most important minor port on the Coromandel Coast south of Madras. In days gone by, long before the advent of railways and steamers, the trade along the coast of India was carried out in native sailing craft called "Dhoneys," from 50 to 300 tons burden. These boats were manned by the descendants of Arab traders who had settled at the coast ports, and had inter-married with the native residents. There exists even to-day a colony of these mariners at Negapatam, who still carry cargo along the coast in their dhoneys; the bolder ones venturing to the Gulf of Martabam, and to the Straits Settlements.

Cuddalore is an open roadstead. Vessels usually anchor in 6 to 7 fathoms. In former days iron from Porto Novo used to be shipped to this country. Ground nut to Europe is now the largest export. In the fiscal year 1937-38—

Imports valued at rupees	4,375,176
Exports valued at rupees	15,406,880

Madras Lat. 13° 06′ N. Long. 80° 18′ E.

In 1639 the East India Company first settled at Madras, previous to that they had a factory at Armogam. At Madras they obtained a strip of land 6 miles long, and 1 mile wide on which they built a factory, and surrounded it with a wall. The first fort was built in 1644.

Before the construction of the present harbour vessels used to anchor in the roadstead in 7 to 9 fathoms. The 9-fathom line was about 1½ miles from the shore. A prevalent ground swell exists tending to cast vessels ashore in spite of precautions. The scope for cables in moderate weather used to be 60 fathoms, and 80 fathoms in rough weather with a swell—bottom stiff clay causing a difficulty to extract anchors. Cargo and passengers were carried from ship to shore in Masula boats, carrying 1½ ton dead load. In 1858 a screw pile pier 1,100-ft. long and 42-ft. broad with a T head 160-ft. long running North and South was constructed, having a depth of 3 fathoms at low water at its head, in order that boats might evade the surf. (Dismantled in 1917. See Proceedings of the Institution of Civil Engineers, vol. ccvi).

The difficulty of the passage of the surf; the delay in shipping and transhipping goods, owing to the small size of the Masula boats; the loss by upsets, and pilfering, led merchants of Madras to make repeated petitions to Government to construct a harbour at Madras. The first proposal was for a breakwater, the committee appointed to consider the proposal in their report of January, 1869, favoured a breakwater as opposed to an enclosed harbour, as for an equal sum of money, it would give more deep water shelter than a harbour. It would create a length of sufficient smooth water at the coast line to enable boats to land and come to jetties. Also vessels can enter and quit more easily from behind a breakwater than through one entrance of a harbour. In 1873 Mr. Parks submitted his proposals for an enclosed harbour.

Mr. G. Roberton, Harbour Engineer to the Government of India, in reporting on the schemes, stated that the breakwater by stilling the surf would remove one of the agents which move the sand, and that shoaling was likely to occur in both the proposals for a breakwater, and that of an enclosed harbour, but he considered the breakwater preferable. He stated that if such a breakwater were constructed, it should be placed in 7 fathoms of water, preferably further out, and be at least 2,000 yards long. Sir Arthur Cotton, who was consulted, considered that the long shore movement of sand was not sufficient to interfere with the success of the enclosed harbour, but from nautical reasons he preferred a breakwater. Col. Orr, R.E., Chief Engineer to the Government of Madras, pointed out that it was evident to all who had studied the circumstances of the Madras beach, that any obstruction opposed to the current must have the effect of arresting the passage of sand which is in constant movement by the combined action of the surf and those currents, and of causing it to accumulate to the windward of the obstacles, and ultimately he, Col. Orr, had no doubt the coast line would be carried to the outer end of the walls of the harbour, and close the entrance. Mr. Parks in reply based on figures given by Col. Rawlins, in 1857, on the quantity of sand which accumulated in front of groynes, calculated that for the triangle of sand between the coast, and a pier extending 1,200 yards from the shore to be filled, would be 160 years.

The proposal for a breakwater was eventually abandoned, and the first stone of the Madras Harbour was laid by the Prince of Wales (the late King Edward VII.) on the 14th December, 1875. The harbour was practically completed in 1881, when in November of the same year the arms were destroyed by a cyclone, which crossed the coast 80 miles south of Madras. (See Proceeding of the Institution of Civil Engineers, vol. clvi., pp. 244-245).

The arms were rebuilt to a stronger section, the height of the whole work was raised 6-ft., and a barrier of 30-ton wave-breaking blocks was deposited at random on the sea face of the arms.

The result of the construction of the harbour was a vast accumulation of sand South of the harbour, while North of the harbour a considerable extent of land and buildings were eroded and washed away; further erosion being prevented by heavy stone revetment.

The Eastern opening gave a rough uncomfortable harbour, and the sand, which, since the commencement of the work had been accumulating South of the harbour, began to flow across the opening, which was silting up at the rate of one foot a year. In 1910, the Eastern entrance was closed, and a North-east entrance was opened, guarded with a protective breakwater wall. The history of the Madras Harbour up to the year 1920 is contained in the following "Proceedings of the Institution of Civil Engineers," viz.—

(1) Remodelling and equipment of the Madras Harbour, vol. cxc.
(2) Coastal travel of sand near Madras Harbour, vol. cxciv.
(3) West Quay, Madras Harbour, vol. ccvi.
(4) Restoration of damage, breakwater end, Madras Harbour, vol. ccx.

Harbours and Ports of the Coasts of South India—continued

In 1923, the extension of the South arm of the harbour eastwards, called the " New Breakwater," or " sand screen " was commenced. The work was designed to prevent sand creeping along the sea, or East face of the harbour. The work was completed and protected by 30-ton wave breaker blocks, in 1926. Fig. 2 shows the Madras Roadstead in 1873. The harbour was built according to Mr. Parks' design, and the subsequent alterations described above are shown in broken lines.

The " sand screen " was effectual in checking the creep of sand along the East face of the harbour. No movement of sand had taken place which could adversely affect the entrance. Vessels up to 700-ft. in length and 31-ft. draught were able to enter the harbour at all states of the tide. The harbour is able to accommodate 13 and 14 vessels of deep draught, besides smaller ones. For most days of the year steamers can berth alongside quays and discharge passengers and cargo with expedition, and at a comparatively small cost. In the last few years the sand problem at the "sand screen" is becoming acute. The contours North of it are advancing Eastwards of their position in 1925 and causing some anxiety to the Harbour Authorities.

The number of vessels that entered the port in the fiscal year 1938-39 was 730. The largest vessel had 15,105 gross tonnage. The deepest draught vessel leaving the port was the ss. " Lachlan," 29-ft. forward and 29-ft. aft.

VALUE OF TRADE, 1938-39 :

Imports,	Private	Rupees*	163,162,525	State Rupees	1,879,111
Exports,	,,	,,	123,113,363	,, ,,	411,273

* A rupee is equivalent to 1s. 6d.

CHIEF IMPORTS AND EXPORTS

Imports, 1938-39	Tons	Exports, 1938-39	Tons
Cement	10,843	Bunker Coal	8,705
Teak Timber (Burmah)...	19,590	Liquid Fuel	23,043
Raw Cotton	3,925	Ores	19,257
Textiles	4,685	Ground Nuts	183,176
Dyeing and Tanning ...	13,961	Tanned Hides and Skins	25,338
Mineral Oils	168,256	Oil Cakes	29,951
Sugar	3,782	Tobacco (unmanufactured)	20,040
Coal	95,011	Onions	25,163
Metals	22,804	Scrap Iron	5,792

The Armogam Shoal and Blackwoods Harbour

Turning to Mr. Roberton's report on the proposed breakwater at Madras, he pointed out that any tendency to travel in the loose bed of sand, must be due to whatever velocity the littoral currents have combined with the oblique action of the surf. . . . These are the two great agents at work moving the sand. If the velocity of the littoral current is not sufficient of itself to carry the sand along the coast, then the withdrawal of the surf, the other agent, would cause the sand to be deposited at any place where the littoral currents alone are at work. In short, if there is such an immense quantity of sand in motion along the shore at Madras, then even a breakwater would not succeed. It would still the surf and remove one of the two agents which move the sand. If Mr. Roberton had inspected the Armogam Shoal and " Blackwoods Harbour," he might have modified his views regarding the effect of the proposed breakwater on the Madras Coast.

The chart Madras to Ramipalem (fig. 3) shows the Pulicat Lake, a shallow backwater; the Armogam Shoal joins the shoal that fronts Pundi Point, and extends more or less parallel with the coast for about 14 miles northward. The depths on the shoal are generally $3\frac{1}{2}$ to $1\frac{3}{4}$ fathoms. It has a least depth of $1\frac{3}{4}$ fathoms, 3 miles nor'-nor'-east of Pundi Point, over which the sea sometimes breaks. Between the inner edge of the shoal and the coast there is a space 3 to 4 miles wide, of still water called Blackwoods Harbour, after Admiral Sir Henry Blackwood, who had it charted, and suggested that it would make a practical harbour; with soundings from $4\frac{1}{2}$ fathoms near shore to 6 to 7 fathoms near the shoal, where ships may anchor by passing round the North end of the shoal, bottom sand with good holding ground. There is also a channel 4 to 6 fathoms depth and $\frac{1}{2}$ mile wide between Pundi Point and the Shoal which leads to " Blackwoods Harbour."

There is a lighthouse at the village of Armogam now called Monapalem, Lat. 13° 53′ N., Long. 80° 8′ E, visible 14 miles, which warns vessels of this shoal. Armogam was where the first factory of the East India Company was established. The remains of the fort built by the Company are near by. The charts of 1848 and 1918 show little change in the shoal and harbour. The Armogam Shoal indicates the nature of design for any shallow breakwater on the coast.

Chart Narsapur to Bimlipatam of 1891, corrected 1914 (fig. 4) (the soundings in fathoms are reduced to Indian spring low water). In 1787 Coringa was an important port in the 800 miles of coast between Madras and the Hoogly River. The East India Company, at that time, owing to the difficulty of navigating the Hoogly River by sailing vessels, were seriously considering Coringa as the principal port on the East Coast, and Mr. Topping, the Government Astronomer, was deputed to report on Coringa as their chief port. The progress of the delta of the Godaveri River seawards has hastened the deterioration of the port, which is now far inland; its place being taken by Coconada, for some time the third in importance of all ports on the East Coast, and considered to have the best and safest anchorage in the Bay of Bengal. The completion of the great Godaveri Irrigation scheme begun by Sir Arthur Cotton in 1854, and later by the construction of the East Coast Railway in 1894, brought greatly increased trade to the port. Coconada is the safest natural harbour on the East Coast of India, but owing to the extension of the Godaveri River, Coconada Bay is silting up. The shore is liable to periodic inundations during severe cyclonic storms. (See Engineering, 8th October, 1937). In the Fiscal year 1938-39 ten sailing vessels with a total tonnage of 1,092 tons and 199 steam vessels with a total tonnage of 66,092 entered the port. In the same year the value of goods imported was rupees 24,663,312, and the value of goods exported amounted to rupees 19,685,121.

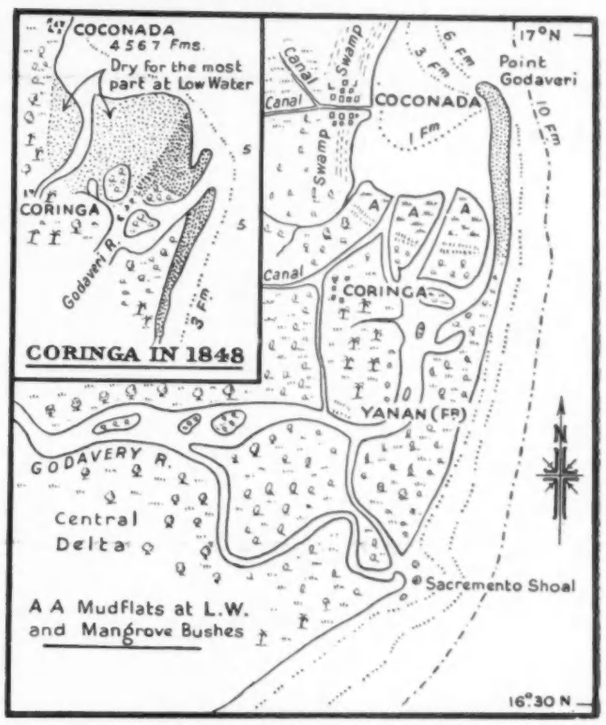


Fig. 4. Coconada Bay—Surveyed 1891, Revised 1914—Soundings in fathoms reduced to I.S.L.W.

Vizagapatam

Four hundred and ninety-eight miles from Madras is built along the shore of a wide bay, receded from the general coast line, and 5 miles across. The bay is bounded on the South by the Dolphin's Nose, a prominent hill 536-ft. high, projecting into the sea; on the North by a small point called " Waltair Point," which separates the bay from the cove called " Lawson's Bay." The East India Company first settled at Vizagapatam in 1682.

Before the construction of the present harbour the Dolphin's Nose protected the roadstead North of it from the South-West Monsoon, and the littoral drift from the South, so that the depth of water at the roadstead had not altered in any way as far as records were available being 5 fathoms at low water spring tide, and distant 3 cables from the shore. During the South-West Monsoon, the beach North of the Dolphin's Nose retrogrades to such an extent that the sea waves used to wash up to the coastal road running East of the town. Such sand as was carried past the Dolphin's Nose, in submerged shoals, accumulating at Waltair Point. During the North-East Monsoon some of this sand was carried back, and a strip of beach formed between the coastal road and the sea (fig 5).

To the West of the town a large tidal swamp 4 miles in extent is drained by a river called the Uppertern, or Salt River, which separates the old fort and town of Vizagapatam from the Dolphin's Nose. The tidal swamp is completely sheltered by surrounding hills, borings showed that a deep navigable channel could be cut through the swamp without difficulty, the chief problem being the sand bar at the mouth of the river. In olden days before being interfered by injudicious reclamation the tidal capacity of the swamp was sufficient to maintain deep enough water over the bar for vessels of 300 tons burden to enter the backwater during spring tides. Mr. D. F. Carmichael, of

Harbours and Ports of the Coasts of South India—continued

the Madras Civil Service, in the Vizagapatam District Manual of 1869 states: " Between the Dolphin's Nose and the fort runs the river which is deep enough to admit vessels of 250 to 300 tons during spring tides."

As already stated in former times, cargo used to be carried along the coast in dhoneys, it was usual for these vessels to avoid the stormy period of the Bay of Bengal by lying up some distance inside the tidal portion of a river, where they were warped into mud docks for their annual repairs. One of the principal ports of call was Vizagapatam, as stated by H.E. the Viceroy of India at the opening ceremony of the Vizigapatam Harbour on the 19th December, 1933. " Shrines in the vicinity of the spot whose sanctity is connected with seafaring men indicates that for many centuries Vizagapatam has welcomed mariners from overseas, and despatched Argosies to distant countries."

The injudicious reclamation of the swamp has resulted in a reduction of its tidal capacity, so that before the construction of the present harbour. A 1½-ton Masula boat found it difficult to negotiate the bar at certain seasons of the year.

Various proposals for a harbour at Vizagapatam have been under consideration. To the Bengal Nagpur Railway must be given the credit for faith in the financial justification of the scheme that the present harbour works were put in hand. Details of the construction of the present harbour are given in the Journal of the Institution of Civil Engineers, Vol. 1, 1935-36.

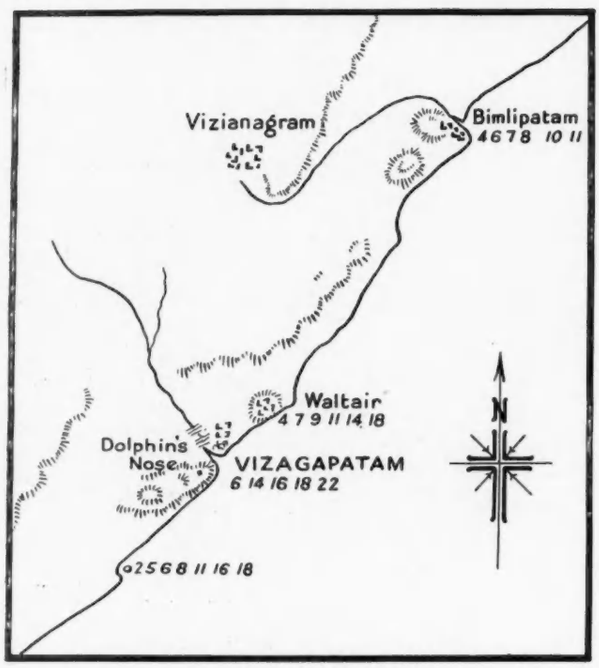


Fig. 5. Chart of Vizagapatam, 1868.

Vizagapatam has been considered to be a convenient outlet for trade of certain northern districts of the Madras Presidency, while opening up the rich hinterland of the Central Provinces. The chief exports are Manganese, ground nuts, linseed and oil cakes. Manganese exports have so far been the mainstay of the port. Recently, however, the port is gaining in importance as a bunkering port, particularly for vessels leaving Calcutta for Europe. Owing to the restrictions in draft for vessels navigating the Hooghly River, the maximum amount of cargo, and the minimum amount of coal is loaded at Calcutta to enable them to proceed to Vizagapatam where they load sufficient coal to enable them to proceed to their next bunkering port. Arrangements are now being made at Vizagapatam for the establishment of increased storage of bunker coal, and for the construction of a new bunkering jetty.

In the fiscal year 1937-38, the port was open throughout the year for ships of draught up to the equivalent of 28-ft. 6-in. on a tide of +2-ft. The vessel of deepest draft which used the port was the ss. " Ryno Maru," which left the port drawing 30-ft. 5-in. In the same period 342 vessels entered the port with a tonnage of 1,093,266.

Bimlipatam is the port for the Vizianagram State. The port was formerly of some importance on the Circar Coast. In recent years trade is being directed to the Vizagapatam Harbour.

The port has 8 fathoms within a mile of the coast, and ships anchor abreast of the town. The small river Gostanaddi rises in the hills west of Vizagapatam and runs eastwards to Bimlipatam. Cargo is shipped and landed from boats in the estuary of the river. The bar at its mouth sometimes closes in September and has to be artificially opened.

Minor Ports.

Excluding the two major ports of Madras and Vizagapatam which are under the control of the Government of India. The Administration Report of the Minor Ports under the control of the Port Department of the Provincial Government of Madras shows a marked growth of seaborne trade, and a tendency to increase, the statement below shows the value of trade of the chief minor ports on the Circar and the Coromandel Coast for the fiscal year 1937-38. (See fig. 1).

A large number of labourers proceed from Calingapatam and northern ports to and from Burmah, and from Porto Novo and Negapatam to the Straits Settlement.

Ports	Value of Trade in Rupees, 1937-38 Imports	Exports
Calingapatam	92,690	2,971,256
Bimlipatam	891,652	3,710,000
Coconada	24,663,312	19,685,121
Masulipatam	642,669	17,844,434
Cuddalore	4,375,176	15,406,880
Porto Novo	340,866	241,137
Negapatam	6,001,994	12,391,071

Correspondence

From Sir Thomas H. Elderton, Chairman of the Commissioners of the Port of Calcutta.

To the Editor of "The Dock and Harbour Authority"

Acetylene Gas Buoy Risks.

Dear Sir,—

The Editorial Comments in the June issue of *The Dock and Harbour Authority* include remarks under the heading, Acetylene Gas Buoy Risks, but I submit that in two respects these remarks are misleading.

They imply that expert opinion is still opposed to the formation of copper acetylide being the cause of the two accidents. You quote from my report " there is expert opinion that this was not the cause of either accident," but the actual words in my report were " there was expert opinion, etc." The experts expressed their opinion before the finding in another buoy of a copper-covered steel pipe coated with copper acetylide, and if they had had this evidence before them it is highly probable their opinion would have been different.

The other respect in which your remarks are misleading is the statement to the effect that a brass nut " lying loose " can only be accounted for by some act of carelessness or neglect. At the time of the accidents operations were being performed which necessitated the loosening of the brass nuts, and the fact that they were then loose was not evidence either of carelessness or neglect. The presence of copper acetylide was not suspected, and if it had been suspected men would certainly not have been allowed to enter the buoys. I admit that I did not explain in the report to which you refer why the brass nuts must have been lying loose, but my report was written for people who were thoroughly acquainted with the facts and copies of the report were only sent to parties who had been fully advised of these facts.

With reference to the letter from the Managing Director of the Gas Accumulator Company (United Kingdom), Ltd., which is printed on page 191 of your June issue, I agree that the primary cause of each accident must have been a defective joint which permitted acetylene gas to escape into the body of the buoy, and that buoys of the type in which the accidents occurred are not dangerous if every joint is at all times prefectly gas-tight. The Calcutta Port Commissioners, however, prefer to adopt a design of gas buoy which is not dependent for safety on connections being always maintained in a perfectly gas-tight condition.

Yours faithfully,

T. H. ELDERTON,

1st August, 1940. Chairman.

[We are glad to publish Sir Thomas Elderton's explanation of circumstances which were not within our knowledge when the comment in question was written. At the same time, we must contend that the form in which the report was communicated to the press is responsible for any misleading impressions which may have been formed. We had not the privilege of receiving a copy of the actual report, but were indebted, as we acknowledged, to the version in *Lloyd's List*, which was worded in the past tense *(oratio obliqua)* throughout, and it was a not unwarranted assumption that the report would have been written in the present tense *(oratio recta)*. This accounts for the substitution in the quotation of " is " for " was "—a departure from strict transcription which we regret, though it may be pointed out that there is nothing in Sir T. Elderton's letter, beyond a conjecture on his part, to justify its condemnation.

If, as Sir Thomas states, the report was written for people who were thoroughly acquainted with the facts and copies were only sent to parties who had been fully advised of these facts, we would venture to suggest that it was scarcely advisable to allow it to appear in the press without a full statement of the circumstances—Editor].

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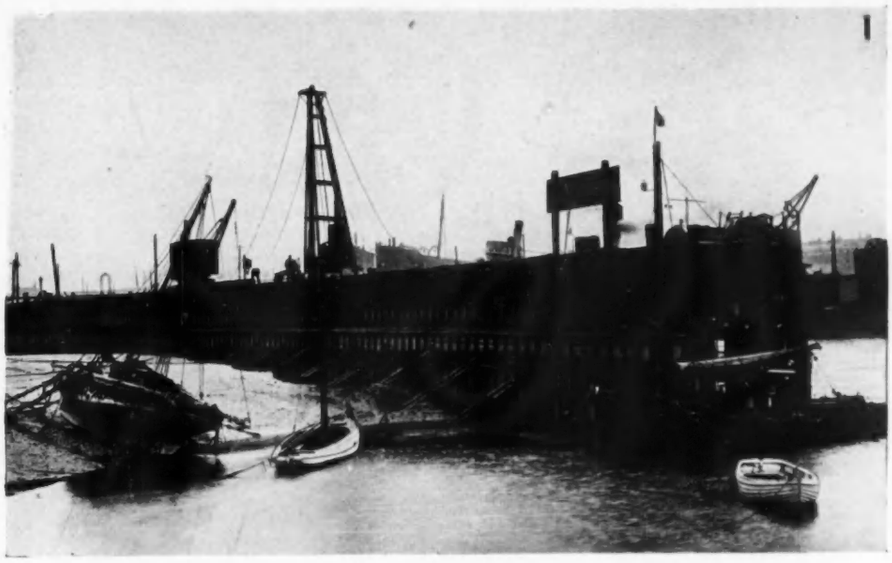

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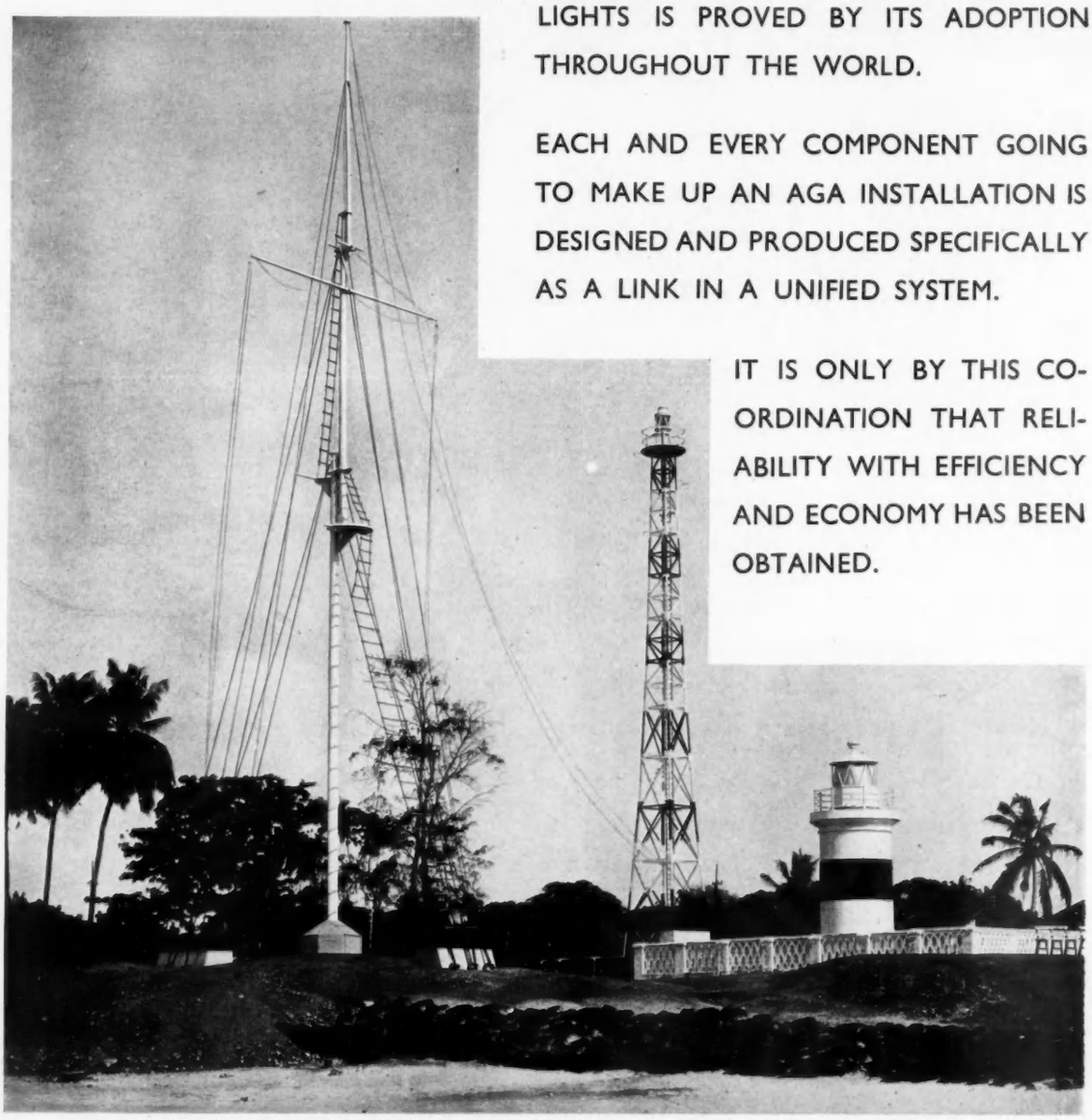

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BEACON WORKS - BRENTFORD - ENGLAND

Notes of the Month

Floods on the Rhine.

Recent heavy rains in the Valley of the Rhine have produced floods which have arrested the movements of shipping at Basle. The river is reported to have risen 5 feet in one day.

Appointment of Canadian Harbour Master.

Captain J. D. Weir, formerly deputy-harbour master, has been appointed harbour master of Sorel in the Montreal Harbour District. The new deputy is Mr. R. Mandeville.

Large Coal Cargo at Swedish Port.

What is stated to be " the largest coal cargo ever to arrive at the port " was discharged recently at Stockholm. It was 11,500 tons of coal shipped by a German steamer from Stettin, engaged in the coal and ore trade between Germany and Sweden.

Liverpool Dockers and their Wages.

There has been some dissatisfaction among dock labourers at the port of Liverpool in connection with the revised rates for overtime, under the new War Emergency Agreement, and a Dockers' Vigilance Committee has been formed to agitate for improved conditions.

Port of Hamburg Damage.

The Port of Hamburg has been repeatedly attacked by the British Royal Air Force, and particularly heavy damage was inflicted on September 8th when docks and shipyards were bombed by relays of aircraft. Included among the targets were the Blohm and Voss noted installations of shipbuilding slipways and floating docks. The dockside buildings were struck and set on fire.

The Sydney Graving Dock.

The Commonwealth Government of Australia have had in hand the preparation of plans for the new large naval dock in Sydney Harbour, but it is stated that before proceeding beyond the preliminary stages, it is necessary to obtain " vital plant " from Great Britain. If the British Government should be unable to supply it, efforts will be made to obtain it elsewhere as there is no intention on the part of the Commonwealth Ministers of allowing the matter to be delayed.

Forwarding Agents' Charges at Liverpool.

Complaints of excessive and unjustifiable charges by forwarding agents in respect of goods despatched from Liverpool to inland towns were referred to at a recent meeting of the Mersey Docks and Harbour Board, when Mr. E. G. Brownhill, chairman of the Traffic Committee called attention to these irregularities, and suggested the matter should be brought before the local Chamber of Commerce.

Damage to the Port of Narvik.

A report on the condition of the undertaking at Narvik of the Swedish Ore Company, shows that the quayside installation, which cost 20 million kronor to construct, has been completely destroyed. The port itself is blocked by some 30 sunken vessels and, it is stated can only be rendered serviceable at considerable expense, time and trouble. Ore exports have ceased from the port since the beginning of April.

French Port Improvement Works.

Orders have been given for the resumption, or continuance, at French ports of improvement schemes which have been interrupted by the war. Repairs are also being undertaken to make good the ravages of recent military operations. Important new works are in course of execution at Marseilles, where the Joliette Basin is being re-modelled and the new Mirabeau and Pharo Basins created. At Séte, a new mole is being constructed. Improvements are in hand at Bordeaux, La Rochelle and Bayonne harbours.

Transport Arrangements at the Port of Bristol.

The Port Emergency Committee of the Port of Bristol has inaugurated a Road Transport Pool Scheme with the object of facilitating the movement of road traffic from the port, and so avoiding delays and possible congestion. Under the scheme, goods from the docks, with certain specified exceptions, must pass through the Pool, the offices of which are in Queen Square, Bristol. Firms wishing to dispatch traffic from the docks by road agencies have to advise the Pool offices with particulars of the goods to be moved, but private owners of vehicles are not prevented from collecting their own consignments. The scheme does not apply to specialised traffic, such as oil and frozen meat, nor does it affect traffic from the docks to local warehouses in the Bristol area.

Traffic on the Dniepr-Bug Canal.

Following the opening on August 10th last of the Dniepr-Bug Canal, which constitutes the closing link in the 900-mile waterway from Danzig to the Black Sea, it is reported that a first consignment of barges has passed through Kiev on its way to Brest-Litovsk.

Inspection of Welsh Ports.

A visit of inspection was recently made by Mr. R. H. Cross, the Minister of Shipping, to survey the damage done by air raiders at ports on the Welsh coast. After his tour, which ended at Cardiff, Mr. Cross said " he was glad to have seen for himself that all the facilities at the ports were in excellent order."

Panama Canal Traffic.

The United States Department of Commerce has been informed that the recently-issued report of the Governor of the Panama Canal zone shows that the number of ocean-going vessels transiting the canal during the fiscal year ended 30th June last, totalled 5,370 as compared with 5,903 in the preceding fiscal year, a reduction of 9 per cent. This is the poorest record for the canal since 1936.

Swansea Dry Dock Finances.

The report of the Prince of Wales Dry Dock Co., Swansea, Ltd., for the year ended 30th April last, shows a profit on working amounting to £32,523 as compared with £10,254 for the previous twelve months. Since the outbreak of the war, a considerable amount of work has been done for the British Admiralty in addition to that on account of private ownership.

New Wharf at Whyalla, South Australia.

An announcement appears in the press that new harbour works, including a wharf, 1,000-ft. long, have recently been completed at Whyalla, Spencer Gulf, South Australia. A channel, 300-ft. in width, has been dredged for a distance of 2,200 yards as an approach to the harbour or basin which is 1,700-ft. in length by 800-ft. in width. The depth in the approach channel and harbour is 25-ft.

Surcharge on Dublin Port Board.

A surcharge of £601 has been made on members of the Dublin Port and Docks Board by the Government Auditor, representing the excess amount paid by the Board for coal over the contract price from the outbreak of war until 31st December, 1939. The Auditor pointed out that the Board did not appear to call for any documentary proof that the additional claims made measured the extent of actual losses sustained by the contractor.

Scarborough Harbour Commissioners.

At the annual meeting of the Scarborough Harbour Commissioners, Alderman J. W. Butler was re-elected chairman, and Mr. J. C. Ireland elected deputy-chairman. In the course of an address, the former mentioned that a surplus of £1,566 in the previous year's accounts had been reduced to £303. There had been a considerable decrease in receipts from vessel dues, pleasure steamers and rents, besides additional expenditure on necessary war measures.

New York New Dry Dock.

It is announced that the House of Representatives in the United States has, on the recommendation of the Naval Affairs Sub-Committee, passed the necessary legislation authorising the construction of the large new graving dock at New York, noticed in a previous issue of this journal. The estimated cost is £2,500,000. The Sub-Committee also recommended the building of another large dry dock at the Atlantic entrance to the Panama Canal zone.

New Port in Costa Rica.

It is stated in a recent issue of *The Engineer*, on information gathered from the United States Hydrographic Bulletin, that a new port has been opened at Golfito, Costa Rica. It is situated near the border of Panama, on the Gulf of Golfito, which is a small bay, on the eastern side of the Gulf of Dulce. The harbour, at present, only affords space for the safe anchorage of three or four large vessels, but the holding ground is good and the harbour well sheltered, being landlocked and surrounded by high hills. There is a fairly strong tidal flow in the anchorage area and the times of high and low water are about the same as those given for the port of El Rincon, which is situated at the upper end of the Gulf of Dulce. Work is about to be started on the construction of a modern pier, or wharf, with water deep enough for the accommodation of large ships: it is expected to be put into commission in May next year. The port is operated by the United Fruit Company.

The Rapid Construction of Piled Piers*

By A. M. ROBERTSON, A.M.Inst.C.E.

THIS article is intended to show that it is now possible to construct reinforced concrete piled piers and jetties without the use of temporary staging and floating plant; to standardise designs to the same extent as was the case with timber construction; and to obtain a speed of construction equal to or greater than that possible when using timber.

Fig. 1 shows a proposed standardised pier for vessels of up to 4,000 tons displacement, the design of which incorporates a number of novel features. Although the general design is of the well-known raker pile type, pre-cast reinforced concrete units have been introduced between the piles (in a longitudinal direction), making it possible to incorporate the following desirable features in the scheme.

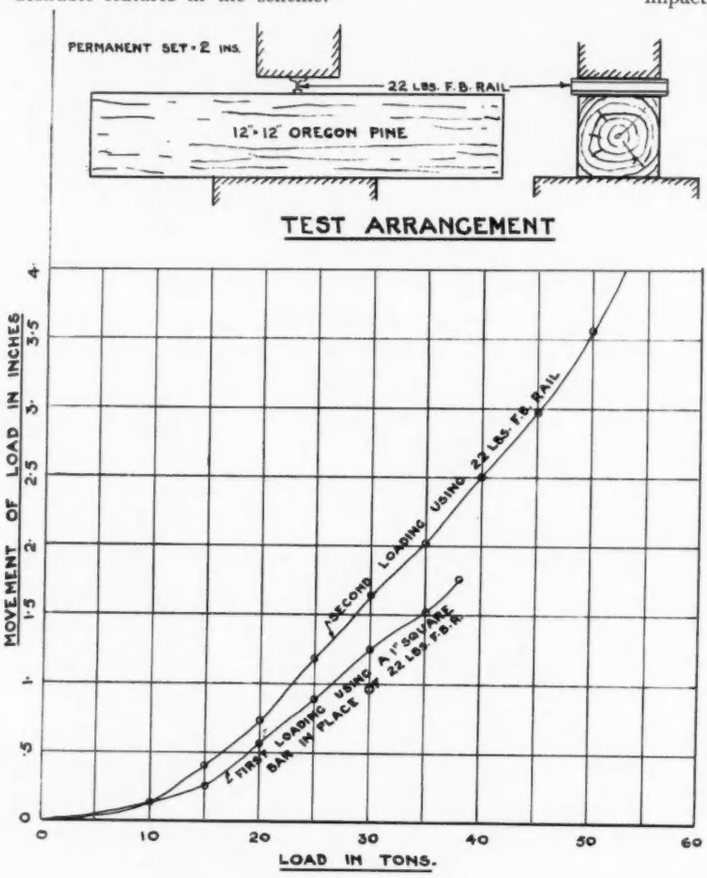

Fig. 2.

(1) The pile frame and crane can be carried on the permanent concrete piles 24 hours after they have been driven.

(2) The crane, piling frame, and concreting trucks, etc., can travel between the shore and the extreme end of the pier without interfering with the construction of the deck; consequently floating plant is unnecessary.

(3) The pre-cast units support the 12-in. by 12-in. waling or guide timbers which, in turn, are used to support the shuttering.

(4) The pre-cast units form the shuttering for the blocks uniting the piles, shutter the awkward sections of the dock between the pile groups, and make sliding shuttering possible for the remaining 76 per cent. of the deck area.

Before proceeding with the detailed description and reasons for the selection of the arrangement shown in Figs. 1 to 6, the reader who is in doubt of the general advantages of raker pile construction is referred to the articles by Mr. O. Arup in *Concrete and Constructional Engineering*,† and "Concrete Structures in Marine Work," by Mr. R. Stroyer. In short, for any given number of reinforced concrete piles driven, the raker piled pier is approximately ten times more efficient than the old type of braced piers in resisting impacts and mooring loads from berthing vessels. The lesser-known advantage of raker piled piers is the possible ease of construction which is the subject of the greater part of this article.

*Reproduced by kind permission from "Concrete and Constructional Engineering."

†January, March and May 1934, and January and February, 1935.

Horizontal Dynamic Loading from Berthing Vessels

This loading is dealt with first as it is of primary importance and has the greatest bearing on all considerations connected with the design of the structure. Although the deck of a reinforced concrete pier or jetty gives great economy by distributing impacts over a considerable length of pier, it is imperative that ample resistance to impacts is provided, as failure to do so may lead to collapse of the entire structure, and not merely of a couple of bents as would be the case with a timber pier. A case is recorded where a braced reinforced concrete pier was pushed over, coming to rest on the bottom with its deck intact.

The proved method of designing concrete piled piers to resist impacts from vessels consists in assuming an inelastic impact and that the kinetic energy of the combined mass of pier and vessel is absorbed by the deformation of the structure. This method is on the safe side provided that:

(a) The static resistance of the pier is such that it can withstand a horizontal load of not less than 200 tons acting at any point along its length;

(b) The absorption of the fendering is only deducted from the total kinetic energy when it is certain that the fendering will come into action.

The factor of safety obtained by using this method can be judged from the following facts:

(1) The higher the static resistance of the pier the greater will be the work absorbed by the vessels themselves during impact. This is apparent both from the absorbed deflection of vessels and the damage sustained by them while berthing. It is common to see trawlers and similar vessels with their bows stove in a few inches. If in such cases a load of 200 tons is active during impact, the work absorbed by the vessels themselves is never less than 8.3-ft.-tons, assuming a 1-in. set of the bow.

(2) Pile trestles, if designed for a factor of safety of two on static loading, will have a factor of safety of four for energy absorption.

(3) The energy absorbed by the elastic compression and shear of the ground around both the tension and compression piles in practically all cases amounts to that absorbed by the axial deformation of the piles.

Of the smaller vessels using piers and jetties, trawlers usually berth bow-on at fairly high speeds and may set up very high stresses in the structure if provision is not made to cushion their impacts. For the purpose of this design the berthing speed of 500-ton trawlers will be taken at 1-ft. per second—a speed often observed. In this case the kinetic energy is

$$\frac{500 \times 1^2}{2 \times 32} = 7.8\text{-ft.-tons.}$$

Vessels of 4,000 tons will be assumed to berth at a speed of 25-ft. per minute (0.416-ft. per second), giving a kinetic energy of

$$\frac{4000 \times 0.416^2}{2 \times 32.2} = 10.8\text{-ft.-tons.}$$

Fendering and Stability of Pier

From experience it is known that 14-in. by 14-in. greenheart piles of the length and spacing shown in Fig. 1 are all that is required to cope with impacts below deck level. It is interesting to note that a single 14-in. by 14-in. greenheart pile 38-ft. long can absorb a blow of 5.5-ft.-tons acting at the middle of its height before fracture. Two of these piles will therefore absorb low-level impacts from vessels up to 4,000 tons.

The work absorbed by the tendering when impacts take place at or near deck level may be great or small according to the arrangement of the fenders. Springs have been used to reduce the work to be absorbed by concrete structures, but for a general-purpose pier, where vessels come in contact with the pier at all angles, springs of the mechanical type may not come into action and do not lead to simplicity and economy.

The 12-in. by 12-in. Oregon timber fixed to the edge of the deck will act as a "safety valve" for severe bow-on impacts. To obtain some indication of the usefulness of this type of fender, the writer carried out a test by forcing the head of a 22 lb. F.E. rail into a length of 12-in. by 12-in. Oregon pine, recording the penetrations and load as shown in Fig. 2. It will be seen from this test that the work absorbed before a load of 50 tons becomes active is not less than 6-ft.-tons, so that bow-on impacts are well absorbed by the type of fender provided. On the other hand, when vessels of about 4,000 tons berth parallel

Rapid Construction of Piled Piers—continued

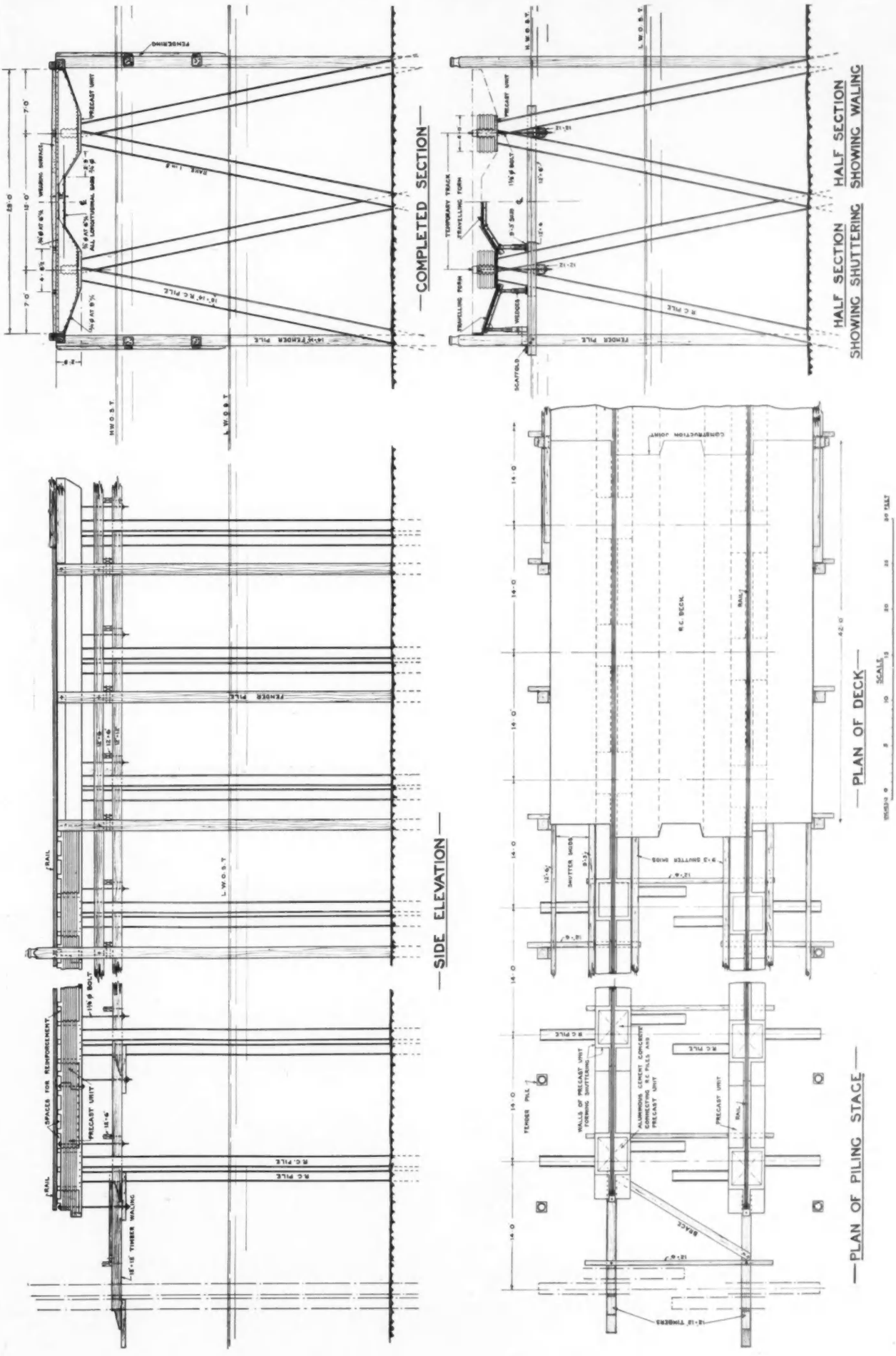

Fig. 1. Suggested Standard Design for Reinforced Concrete Piers.

Rapid Construction of Piled Piers—continued

to the pier at high tide, the contact line may be at deck level, where the impact may act over a considerable length and area if the fendering at this level is flush, in which case the stress in the timber would be exceedingly small and the work absorbed by it negligible. To ensure that the fendering will absorb blows from vessels berthing side-on at high tide, the fender piles have been arranged to project beyond the line of the upper 12-in. by 12-in. fenders, and rope cushions have been provided between the fender pile heads and the concrete deck.

To check the stability of the structure the following three cases of impact require consideration:—

(1) Bow-on blows of 7.8-ft.-tons acting normally to the pier;

(2) An impact of 10.8-ft.-tons distributed equally over, say, 150-ft. of pier, due to 4,000-ton vessels berthing exactly parallel to the pier; and

(3) An impact of, say, 5.4-ft.-tons acting over a short length of the 12-in. by 12-in. fender fixed to the deck caused by 4,000-ton vessels coming in on the slant and failing to make contact through a fender pile.

Case 1.—The deck is such that all the piles in a 100-ft. length of pier will resist a load acting at any point along its length. The static resistance of one trestle containing two piles driven at a rake of 1 in 5 is 15 tons, giving the pier a static resistance at any point along its length of $\frac{114 \times 15 \times 2}{14} =$ 250 tons. From Fig. 2 it will be seen that this is ample resistance for the 12-in. by 12-in. timber to absorb the 7.8-ft.-tons.

Case 2.—Eleven fender piles would be active in this case. Each of the cushions can transmit a load of 30 tons to the deck, and in so doing squeezes up 1-in. In this way the eleven pile cushions absorb $\frac{11 \times 1 \times 30}{2 \times 12} = 13.7$-ft.-tons, which is ample.

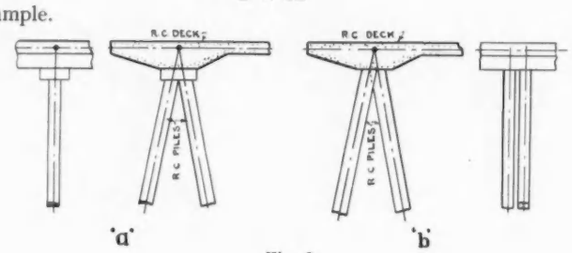

Fig. 3.

Case 3.—The concrete work will be called upon to a much greater extent to resist this impact. The weight of pier which can be taken as active is 450 tons; this reduces the velocity of the combined mass of vessel and pier to $\frac{2000 \times 0.416}{2450} = 0.34$-ft. per second, which reduces the kinetic energy to $\frac{2450 \times 0.34^2}{2 \times 32}$ = 4.45-ft.-tons. When vessels come in contact with the 12-in. by 12-in. fender fixed to the deck the contact area will be sufficiently small to cause the timber to crush $\frac{1}{4}$-in., and this, combined with the 0.2-in. deflection in the concrete structure (pile trestles), gives a total movement of 0.45-in. and an absorption capacity of $\frac{250 \times 0.45}{2 \times 12} = 4.7$-ft.-tons, which is ample.

The maximum horizontal static load a 100-ft. length of pier may be called upon to resist will be due to a wind load of, say, 60 lb. pressure per square foot acting on a vessel, namely, $\frac{60 \times 100 \times 30}{2240} = 80$ tons, which will not be combined with an impact, as it is impossible to berth a vessel during a severe gale.

Reinforced Concrete Piling

The perfect arrangement of piles should be such that the forces (centre lines) in the piles and deck structure are concurrent in any plane. To satisfy this requirement the piles of a trestle have to be arranged opposite each other as shown in Fig. 3a. By lapping the piles with a space between them at deck level, the arrangement adopted and shown in Figs. 1 and 3b has the following advantages over that shown in Fig. 3a.

(1) Pile driving is not delayed while awaiting the cutting and removal of the heads of the first driven piles of a trestle.

(2) Should the required set not be reached at the assumed level, driving can be continued below the cut-off level with practically no loss of time. In this way a pile which is found to be too short for its position may be driven to the required set before the extension is undertaken, thereby cutting out delays occasioned by having to wait for the extension to harden sufficiently to continue driving.

It is hoped that the following miscellaneous notes regarding the advantages of raker piling for piers and jetty works may reassure engineers who have not had experience with them.

(1) With raker piles arranged to meet in pairs at deck level the risk of settlement or failure to carry vertical loads due to damage below ground level is reduced by half.

(2) Should a pile twist during driving and cause doubt in the engineer's mind, it is usually found that its partner, driven in a different area, behaves perfectly and can be relied upon to support severe deck loading.

(3) Likewise it is safe to stop driving one of a pair should the pile be driven to the assumed depth or twist before the full desired set is reached. In other words, the factor of safety of one pile may be reduced on account of the increased factor of safety obtained when using two independent piles to support approximately the same point of the deck. Consequently, time normally required to extend piles is saved.

(4) It is easier to pitch a raker pile than a plumb pile. For example, an 18-in. by 14-in. pile 50-ft. long slung as shown in Fig. 4 will hang at a rake of 1 in 7, and the head can very easily be pulled back to the frame by simply slewing the crane, allowing the pile to rest against the bottom of the frame or waling. To pitch a plumb pile slung in the manner shown in Fig. 4 requires from three to six times as long as a raker pile.

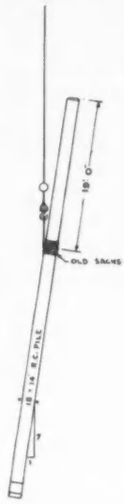

Fig. 4.

(5) Driving is just as simple, and the piles have no greater tendency than plumb piles to drive out of line or rake.

(6) Should a vessel crash through the fendering and damage the permanent concrete piles, it is most unlikely that both piles of any one trestle would suffer; consequently the deck will remain intact.

(7) The greatest bending moment set up in the piling due to movement of water is in most cases caused by the rush of water from propellers, but as each trestle has one of its piles driven well back from the face and out of the rush, no danger from propeller wash is to be feared.

The greatest practical advantage of raker piles is, of course, the elimination of tide work in the construction of the permanent works. Next to this comes the elimination of tide work in the construction of the falsework if the raker piles can be used to carry and give lateral support to the falsework. It has been proved in practice that simply connecting the heads of the raker piles by means of a slab or block of concrete provides a most efficient means of supporting and bracing the falsework. This is shown in its simplest form in Fig. 5.

The principle shown in Fig. 5 has been incorporated in this scheme, and the capping block has further been used to connect the pre-cast units to the piles. The 12-in. by 12-in. timber between the piles (Figs. 1 and 5) has a threefold purpose, namely, waling, support for piles until united, and support for shuttering. During pitching the piles cantilever beyond the 12-in. by 12-in. timber, which restricts the steel stress due to this action to 6,300 lbs. per square inch, assuming four $1\frac{1}{4}$-in. bars in each 18-in. by 14-in. pile. Again, after driving, if no support was given to a similar raker pile, it would be subjected to stresses of 17,600 lbs. and 650 lb. per square inch approximately in steel and concrete respectively due to cantilever action alone; these stresses could only be neutralised by carefully separating the pile heads under a pre-determined load, an operation which would only be resorted to in the case of an accident. The necessity for retaining all the raker piles in the "as driven" rake is therefore paramount.

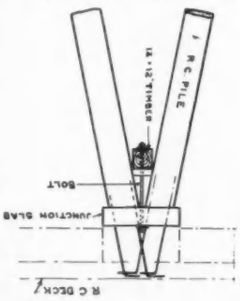

Fig. 5.

Pre-cast Units and Deck Structures

To support and stiffen the falsework by the reinforced concrete piles when the latter are arranged to lap at deck level requires special consideration, in view of the tendency of the piles to rotate a junction block or slab and set up high torsional stresses in themselves. This is only of importance before the deck is cast, when the piles may each carry a load of, say, 25 tons, and the horizontal reaction of each would be 5 tons, creating a couple amounting to 224,000 lb.-in. tending to rotate the blocks connecting the piles. In the design shown in Fig. 1 this moment is of very little consequence, as the bottom of the pre-cast unit is so wide that one $\frac{3}{4}$-in. diameter bar resists the tendency of the junction block to rotate, as well as serving other purposes.

Rapid Construction of Piled Piers—continued

The pre-cast units are 14-ft. long and incorporate an open-bottom reinforced concrete box shutter for the rapid connection of the piles and the units by aluminous cement concrete; they are designed to shutter the deck between pile groups and to provide a true line irrespective of the usual driving irregularities of the piles, making possible the use of a sliding shutter of constant width. The bottom slabs of the pre-cast units also provide straight and stiff edges against which the shutter can lap and be drawn tight, in fact, pre-stressed—a most desirable operation if economy of shutter-supporting timber is to be obtained and loss of mortar and lipping avoided.

A stiff deck structure, with continuous longitudinal bands of steel as shown in Fig. 1, is essential if the maximum number of raker piles is to come into action to resist impacts. The deck is also ideally suited to carry any of the following loads:—

(a) 20 tons acting on a 2-ft. square, deemed to cover heavy objects roughly handled;

(b) 12-ton lorries combined with 3-cwt. per square foot;

(c) Railway wagons with shunting loco, combined with 12-ton lorries and 3-cwt. per square foot;

(d) 4-ton loco cranes combined with 12-ton lorries and 3-cwt. per square foot;

(e) Portal cranes with wheel loads not exceeding 35 tons, combined with 12-ton lorries and 3-cwt. per square foot; and

(f) Bollard pulls of 15 tons acting vertically upward or downward and combined with the previous loads.

Although no pier would be subjected at one time to all these loads, the simple deck shown has been designed (at no extra cost) to have universal load-carrying properties which is a most desirable feature if standardisation is to be fully obtained. A wearing surface of 4-in. to 6-in. of plain concrete has been preferred to granolithic for reasons of simplicity, and the ease with which railway tracks can be re-aligned to suit the client's changing requirements.

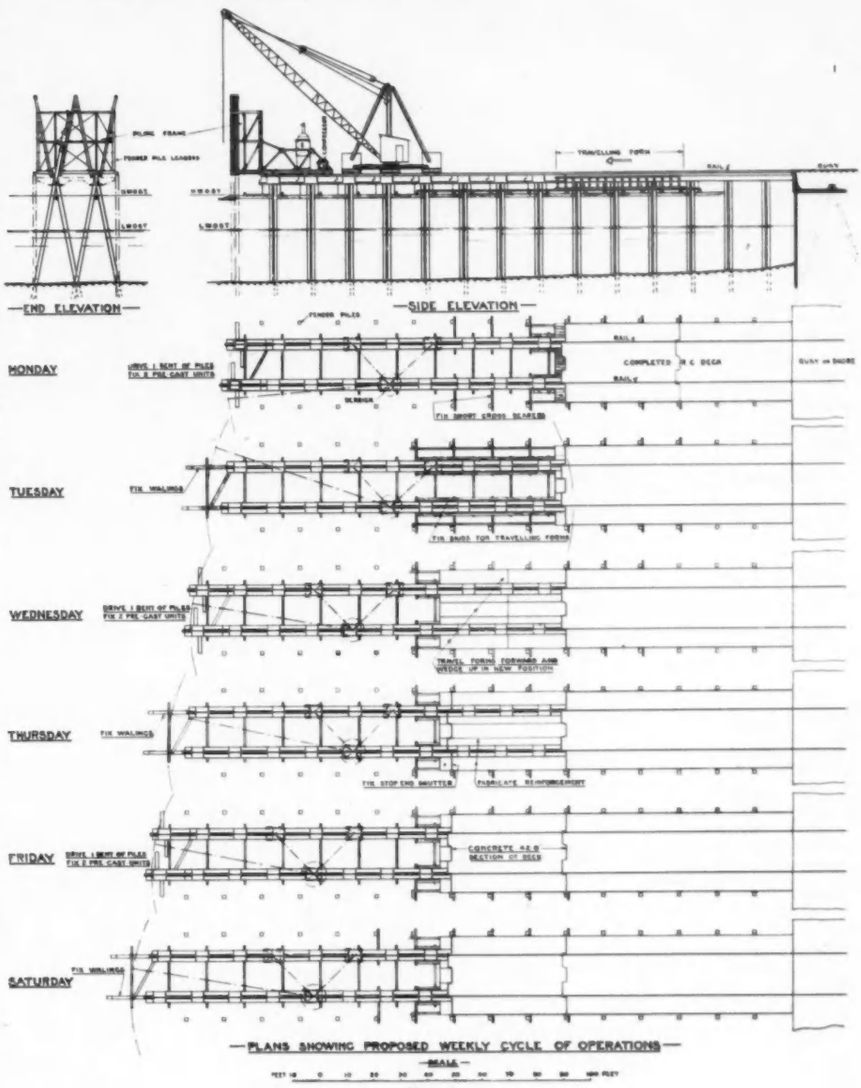

Fig. 6.

As speed of construction is always controlled by the number of operations that can be carried out in a given area, in a congested area such as the deck of a pier under construction, to avoid building shuttering will in itself greatly ease most other operations and lead to rapid construction. Apart from pre-cast unit links, all deck bars are ¾-in. diameter, and the number of different types is reduced to seven.

Plant and Temporary Works

The plant required would consist of a travelling portal or single-line type bogie-track derrick crane and a cantilever piling frame 30-ft. high with six fixed leaders as shown in Fig. 6. The crane, which would work over the piling frame, would also left, stack and transport piles and pre-cast units from the yard to the end of the pier. The compressor and boiler would be housed on the piling frame. The temporary works, other than the shutter panels, would simply consist of shutter skids and the 12-in. by 12-in. walings previously described.

Programme.

The rate of construction possible with this scheme is 42-ft. (three bays) per week; that is, a 400-ft. pier in ten working weeks. One 42-ft. length of deck would be cast, using rapid-hardening Portland cement, on Friday each week, and all operations arranged according to the following proposed programme and as shown diagrammatically in Fig. 6.

Monday.—Drive four concrete and two fender piles and cut their heads. Connect up and align two pre-cast units and concrete junction blocks, using aluminous cement.

Tuesday.—Fix and brace 12-in. by 12-in. walings. Fix shutter skids. Move crane shorewards, picking up walings now freed. Stack piles in yard and load up bogie with six piles (four concrete and two timber) for the next day's work.

Wednesday.—Travel crane and trailer bogie to seaward end, where frame has been moved over piles driven on Monday. Drive four concrete and two fender piles; cut off their heads, and fix two pre-cast units in position as on Monday. Strip and move deck shutters to new position and make ready for fixing reinforcement.

Thursday.—Same as Tuesday, but double the number of piles to be taken to seaward end. Also set up reinforcement in deck sections, and fix bulkhead or stop-end shutters.

Friday.—Concrete 42-ft. section of deck. Drive four concrete and two fender piles and fix the pre-cast units in place.

Saturday.—Set and brace 12-in. by 12-in. walings.

Sunday.—Leave free for contingencies.

Conclusion

Although the plant required may appear somewhat expensive, piers of 400-ft. and over would cost less than piers constructed in the usual way. Further, the scheme lends itself (mainly through its simplicity) to thorough organisation on the site, which would result in first-class work with the minimum of waste both in skilled labour and materials.

The construction described is applicable to wider piers where three or four parallel rows of trestles and pre-cast sections would be necessary.

Riverside Installation on the Thames.

The reconstruction of Fresh Wharf adjacent to London Bridge has recently been completed and the wharf brought into commission. The wharf can accommodate ocean-going ships up to 430-ft. in length and at high water affords depth of water sufficient to take ships drawing 26 or 27-ft. At low water the vessels rest on the river bottom for a short time. The wharf is equipped with 5 electric cranes, each with a lifting capacity of 5 tons and a working radius of 100-ft. There are two conveyors built inside the framework of the cranes which enable quantities of goods to be handled expeditiously.

Fish Pier and Cold Store at Gloucester, Mass., U.S.A.

Description of a Recent Interesting Installation

By JOHN AYER.*

METHODS of processing, freezing and marketing fish have changed materially during the last two decades. The new fish pier at Gloucester with its cold storage and stores buildings provides a modern plant where fish may be frozen rapidly and efficiently so as to meet present day demands for shipping and marketing. It is a new plant in an old setting, for Gloucester has always had an important fish business.

Gloucester, since earliest Colonial days, has been a fishing port, and as such it is to-day famous throughout the country. Whenever one thinks of Gloucester, fish always come to mind. For years, Gloucester held the lead in the fish business of the Atlantic Coast, but sometime before the beginning of the present century, it was outstripped by Boston. Even for several years after the opening of the fish pier in Boston in 1914, the fish landings at that port were only about double the business at Gloucester, approximately 100 million pounds annually in Boston and from 50 million to 60 million pounds at Gloucester. Between 1920 and 1930, however, the Boston fish business increased at a remarkable rate, while that at Gloucester averaged less than in the 1914-1920 period. Since 1930, Boston's business has been more nearly constant, while Gloucester's business, until 1939, has at no time been as large as it was in 1918 and 1919 With the opening of the fish pier at Gloucester, however, business has shown a very considerable increase. During the six months' period from June to November, 1939, inclusive, the fish landed at Gloucester averaged over 8,000,000 pounds per month.

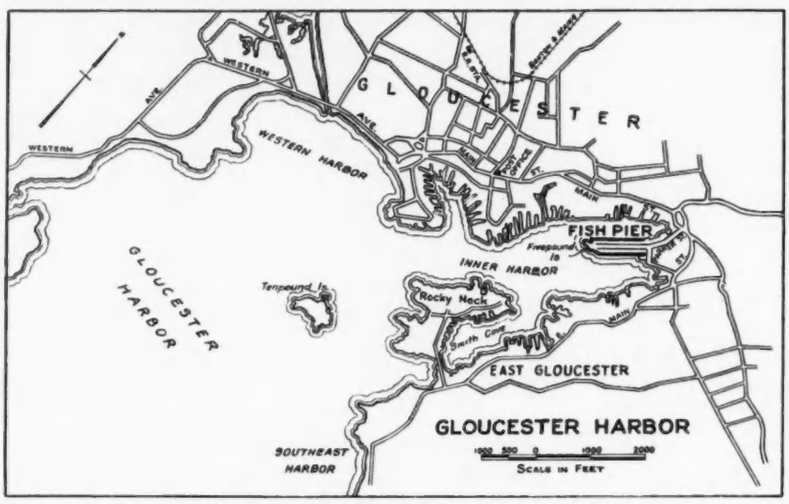

Fig. 1. Plan of Gloucester Harbour Showing Location of New Fish Pier.

Gloucester's supremacy in the fish trade came at a time when the trade was essentially in salt fish. While the demand for salt fish has not materially increased for over a generation, so far as domestic trade is concerned, sales of fresh fish have increased rapidly due to the great advance in marketing methods. The filleting of fish, which was started at the Boston pier shortly after 1920, has become extremely important and this, combined with better methods of handling and shipping, has built up very rapidly the Boston business.

The need of modern facilities for handling, freezing and storing fish at Gloucester had been recognised for a long time and in 1931, this came to a head with the organisation of the Gloucester Fish Pier Corporation.

The Commonwealth of Massachusetts appropriated $660,000 the same year for the construction of a fish pier at Gloucester on two conditions; first, that the City of Gloucester should provide the site and, second, that the Gloucester Fish Pier Corporation or a similar corporation should lease the pier and erect fireproof buildings thereon. Because of the depression, although the Commonwealth was ready to go ahead with its part, the Corporation was not able to finance the buildings. In 1937, however, a grant was received by the Commonwealth from the Public Works Authority of the Federal Government which enabled it to construct not only the pier as originally proposed, but also the cold storage plant on the pier. The grant, together with the money available from the Commonwealth, provided $1,200,000 for the construction of the pier and plant.

The Site

The site finally selected is known as the Fivepound Island site and is located at the north-easterly end of Gloucester Harbour (see figure 1). Fivepound Island is a small, rocky area some 1,000-ft. from the inner end of the harbour and it was proposed to fill the area out to Fivepound Island and locate a storage plant at the outer end of this newly-made land. The City of Gloucester obtained the proposed site, turned it over to the Commonwealth and began improving the approach from East Main Street to the site. The city has also furnished water and sewer connections for the use of the new pier.

The Fish Pier

The pier as now constructed is about 1,000-ft. long by 300-ft. wide (See figure 2). A granite-faced concrete retaining or sea wall on a pile foundation was built along the north-westerly side of the area and tied back by steel rods to pile and timber anchorages. Along the south-easterly side of the area an earth dyke was built from the shore to the island nearly parallel to the wall. The pier was formed by filling the rectangular area bounded by the old shore, the sea wall, Fivepound Island and the dyke. The fill was secured partly by hydraulic dredging from the channels on each side of the pier and from the berthing areas alongside the wharves, and partly by gravel from a borrow pit. A timber pile wharf with a concrete deck was constructed along the north-westerly side of the sea wall extending nearly from the shore to Fivepound Island. Two small timber piers were constructed outward from the dyke into the easterly channel as fitting-out wharves for fishing boats.

The City reconstructed Parker Street from Main Street to the pier to furnish a wide, straight and nearly level access road. This street was continued the length of the pier as a wide road, allowing ample space for trucking or loading vehicles from the present or future buildings. Two buildings were constructed: namely, a Cold Storage Building and a Stores Building.

The Cold Store

The Cold Storage Building is located between the road and the wharf, at the island end of the pier, where ledge or hardpan foundations were secured at reasonable depths. This is a four-storey structure of reinforced concrete with brick facing and with provision for adding a fifth story in the future. (See figure 3). The building except for a few warm rooms on the first floor is heavily insulated with board cork insulation. On the first floor are located a general office, a machine room, a shipping and receiving room, a dressing room with toilets, ice-making tanks and two ice storage rooms. The main ice storage room at the inshore end of the building extends up to the fourth floor. Above this on the top floor is a separate room for storage of ice to be crushed for use of boats and shippers. The second floor contains the five freezing rooms and three cold storage rooms, one of which may be readily converted to fish freezing. The third and fourth floors each contain four large cold storage rooms. Two elevators are located near the centre of the building with landings at each floor. Both are enclosed in an insulated air lock to prevent draughts of warm air through the elevator shafts. Wide, straight corridors extend both ways from the elevator landings the length of each floor, providing easy access for trucks from the elevators to all freezing and storage rooms. The nominal capacity of the cold storage rooms is 5,000,000 pounds of fish and the daily freezing capacity of the four cold blast rooms and one bench coil room is 200,000 pounds. The ice plant has a nominal capacity of 50 tons of ice per day and the ice storage room has a capacity of 800 tons of ice.

The refrigeration is provided by seven electrically driven ammonia compressors in the machine room. All the freezing

*Of Messrs. Fay, Spofford and Thorndike, Consulting Engineers, Boston, U.S.A.

Fish Pier and Cold Store at Gloucester, Mass., U.S.A.—continued

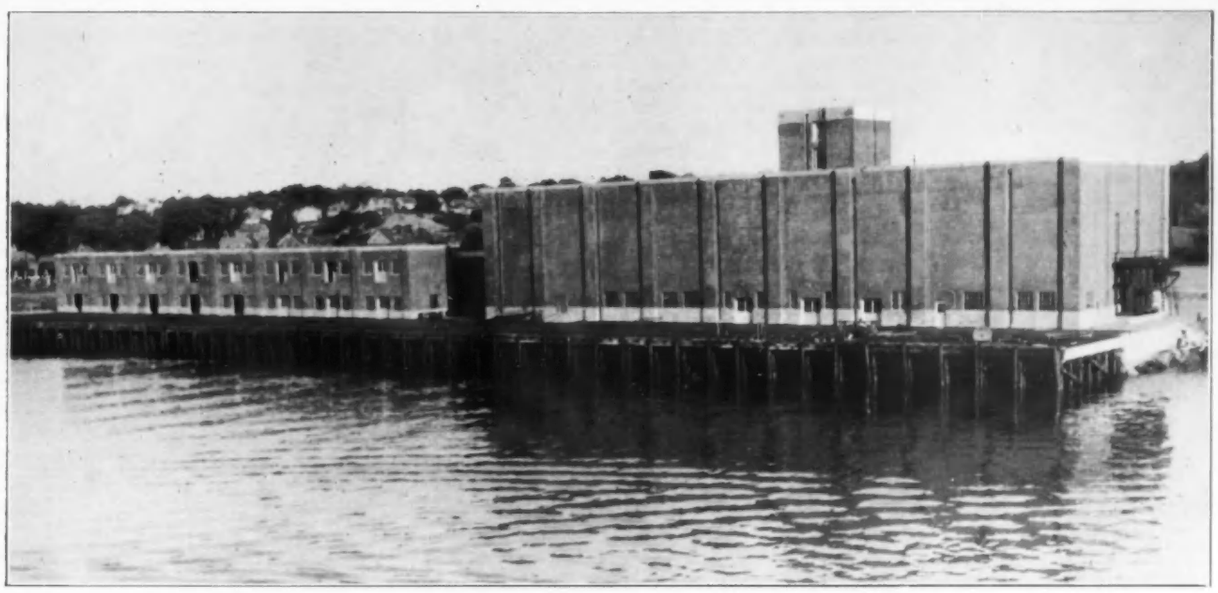

Fig. 2. The New Gloucester Fish Pier. Elevation of buildings looking South-easterly from City. Cold Storage building at right.

and storage rooms are cooled by the direct expansion of ammonia in the pipe coils usually suspended from the ceilings throughout the buildings. This direct expansion method costs less in the first instance and the cost of operation and plant depreciation is less than would be the case if the older brine system were used. Large pumps, connected to a sea water intake in the machine room, provide salt water for cooling the compressors, for the ammonia condensers and for washing fish. The water for fish washing is chlorinated. A tank at the top of the elevator shaft serves as storage for this utility water system. Electricity is furnished by the Gloucester Electric Company at 4,000-volts for the operation of the compressor motors. The voltage is reduced by transformers for operation of smaller motors and lights throughout the buildings. A contract for electricity provides for payment based on the maximum demand without any charge for the kilowatt hours used. Since the maximum demand occurs when fish are being frozen in spring or summer, current is used for electrically heating offices, etc., during cold weather without any additional charge. A very complete switchboard on which are mounted the meter, starting switches, gauges, etc., is located in the machine room. The temperatures in all the freezing and cold storage rooms are automatically maintained by a system of thermostats and ammonia float controls. Four vertical shell and tube ammonia condensers 14-ft. high are located at the end of the building outside the machine room and the cooling water, after passing through these condensers, is discharged through a short pipe to the harbour near the end of the wharf.

The rooms for fish freezing include four " cold blast " rooms in each of which over 40,000 pounds of fish can be frozen in from 8 to 16 hours. Each room has a clear width of 10-ft. permitting a three-row width of steel racks, containing the fish on shelves, to be brought in on jack lift trucks. Air cooled by ammonia coils to a temperature of 30 degrees below zero is blown at high speed across the room through the shelves of fish until the fish are all frozen. Most of the fish to be frozen are boxed fillets processed and packed by dealers but certain varieties of fish continue to be frozen whole in pans. The latter are referred to as " round fish." Besides the cold blast rooms, there is also one " bench coil " room twice as large as a cold blast room where about 60,000 pounds of fish can be frozen in a 30 to 40-hour period. This room contains tiers of ammonia pipe coils on which the pans or boxes of fish to be frozen are laid. No fans are used in this room but the product is frozen slowly by the direct transfer of heat to the pipe coils. This method is being largely superseded by the cold blast method described above since the more rapidly the fish can be frozen the better the frozen product.

Incidental to the fish freezing, but nevertheless of considerable importance, is the manufacture of ice since large quantities are used to preserve the fish on the fishing boats and in the stores and in transit. Two ice-making tanks are provided, each of which holds 60 tons of ice blocks in cans, each block weighing about 300 pounds. The cans are suspended in brine which is cooled by ammonia expansion coils in one end of each tank. These blocks are normally frozen in about 40 hours. While the capacity of these tanks provides more than the nominal 50 tons of ice per day, they are designed to be operated intermittently when the power is not being used for fish freezing, thereby saving considerably on the cost of electricity by keeping the peak demand low. The large reserve ice storage provides sufficient ice to carry through the parts of the year when large amounts of ice are required and power is needed for other uses. An ice conveyor and hoist serve to pile the blocks of ice in the storage room as well as to lift them to the top floor where the ice crushers are located. The crushed ice may be either handled by chute to motor trucks for icing boats or by gasoline propelled cars over a connecting bridge to the roof of the Stores Building where it may be dumped in a chute at any one of the stores.

The fish storage rooms on the second, third and fourth floors are designed for loads of 250 pounds per square foot and for operating at a temperature of zero degrees Fahrenheit. These rooms are capable of storing up to a maximum of five million pounds of fish with adequate space left for aisles.

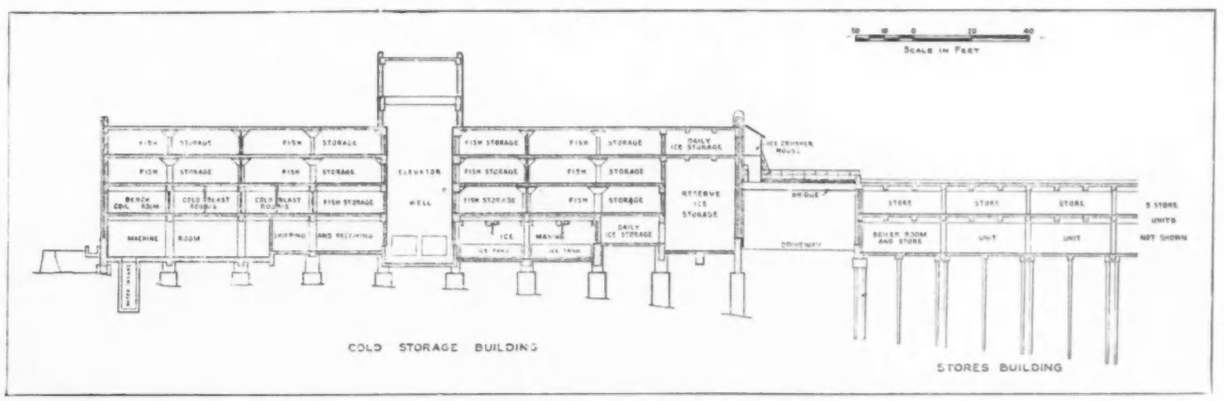

Fig. 3. Longitudinal Section.

Fish Pier and Cold Store at Gloucester, Mass., U.S.A.—continued

The Stores Building

The Stores Building, a group of eight stores in one building available to fish dealers for receiving and processing fish, is provided close to the inner end of the Cold Storage Building. This building is two storeys in height and sixty feet deep, connected to the Cold Storage Building by a bridge and a pipe tunnel. Each store unit is 30 feet wide, making the building 240-ft. long. This building is of steel frame with concrete floors and brick exterior walls. The partitions between stores are of hollow tile curtain wall construction, permitting moving of partitions to alter the interior layouts. Space has been left at the inshore end of this building for the addition of another similar group of stores.

The first floor of each store unit is arranged for receiving fresh fish brought in (from boats) on the wharf side, processing, and packing, and for loading into trucks at the platform on the street side. There is a small cool room for temporary storage of fish on this floor as well as an ice box for crushed ice brought from the Cold Storage Building. The street side of the second floor of each unit is planned for an office with toilets and dressing room and the balance of this floor left for ordinary storage such as boat gear, boxes, etc. Each store unit is provided with salt water, fresh water, and hot water supplies and with electric power outlets. A steam heating plant located in the first store furnishes heat for all the offices in this building.

The area of the pier between the road and the dyke along the south-easterly side of the pier has been left for future buildings. There is also considerable space left on Fivepound Island at the end of the road for building expansion or outdoor storage of equipment.

City water is provided from mains in Parker Street and a sewerage system on the pier connects with the City Sewerage System at a small pump house at the end of Parker Street.

The pier and buildings provide for Gloucester what we believe is the most modern, the most efficient and the most economical plant of its kind in this part of the country.

The Fish Pier, together with the Cold Storage Building and the Stores Building, are owned by the Commonwealth of Massachusetts and are leased to the Gloucester Community Pier Association. The Cold Storage Building is sub-leased by the Association to the Gloucester Ice and Cold Storage Company, which company operates the cold storage plant.

The Pier itself, including sea wall, dyke and wharf, was designed in the office of the Massachusetts Department of Public Works, under the supervision of Mr. Francis L. Sellew. The Cold Storage Building and the Stores Building were designed by Messrs, Fay, Spofford & Thorndike, and all structures were built under the supervision of Mr. Sellew. Messrs. Fay, Spofford & Thorndike served as Consulting Engineers on the construction. The contract for the sea wall, wharves, dredging and filling was awarded to the Bay State Dredging and Contracting Company, of East Boston; for the Cold Storage and Stores Buildings to the H. L. Hauser Building Company, Inc., of Boston; and for the Freezing and Ice Making Equipment to the Frick Company, Inc., of Waynesboro, Pennsylvania.

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*The Use of Oil Engine Power for Dock and Harbour Work**

By A. C. HARDY, B.Sc., A.M.Inst.N.A.

Continuing our investigation of the uses of the oil engine in the "afloat" section of the main table shown on page 147 of the April issue it is advantageous now to remark on dredgers, the type of floating power plant upon whose successful operation the trade lanes leading to the world's largest and smallest ports are kept open. Few floating structures combine in a more unique and ingenious form all the requirements of the mechanical engineer and his problems with those of the naval architect. Few ship types, if such a term can be applied to dredgers, operate under such widely differing circumstances. In few ship types, possibly for obvious reasons, has the oil engine been a slower "starter."

Its application to what may be broadly termed the digging type of dredger has been retarded partly by the physical difficulties of the transmission of power from a horizontal or vertical prime mover to the dredger machinery and partly because of doubt expressed by designers as to the ability of the oil engine to stand up to the strenuous duties the bucket and dipper dredger are called upon to perform. The suction dredger or indeed the pipe line dredger, working with a floating pipe line, is a somewhat easier proposition because the main duty of the oil engine is to drive the centrifugal pump and here direct coupling is possible, although many designers have thought it desirable to interpose some form of shock resisting device such as an hydraulic coupling between the prime mover and the pump. Whether a dredger be a bucket dredger or a suction reclamation dredger, whether she be self-propelling of non-self-propelling, of hopper or non-hopper type, the power requirements are as big as they are varied. In fact dredgers of all kinds have long appealed to protagonists of Diesel-electric propulsion in ordinary ships if only because of the very obviousness of the central power station idea. A steam driven suction reclamation dredge needs power for the dredge pump or pumps for winches and windlasses on deck, for raising and lowering the dredge arm, for slewing this and for turning the cutter head. In addition there are workshop requirements, lighting and heating . . . all of which functions electricity is well suited to carry out. The central power station or rather the central source of energy in such a dredger is actually situated in the boiler plant.

The economics of the whole dredging system are bound up in the pounds of fuel consumed per pound of steam produced per hour in those boilers. On the other hand, with Diesel-electric drive a generator set or sets form the central energy source. Many people have felt for some time that the modest fuel demands of the oil engine, say 0.38 lbs. of oil per horse power developed per hour make it particularly suited to work of this kind. If, too, the dredger is self-propelling, power can be tapped off from the main generating source and used to operate electric motors attached to the shafts. The question, in this instance, is one on all fours with that of lightship powering as I have explained in my last article in these columns.

Good as the case appears to be for electricity the choice is ultimately governed by considerations of first cost as well as by the confidence, or otherwise, with which designers and port authorities regard electricity for marine purposes. These undeniable factors have produced in the course of time, therefore, several interesting combinations of machinery, thus, recent years have seen the production of self-propelling dredgers in which straight Diesel drive was employed for propelling the ship and a Diesel-electric power plant supplied the necessary energy for operating the dredge pump and all other auxiliary equipment.

On the other hand, if we turn to the big rivers of the central plains of the United States of America we find the United States Army Corps of Engineers using shallow draft scow-shaped hulls on and in which all the equipment of a pipe line dredge has been mounted. A Diesel engine is coupled direct to the main dredge pump whilst the Diesel-electric power plant supplies electricity to the whole of the vast auxiliary requirements of the ship, including two small-diameter D.C. electric motors direct coupled to propellers by shafting, the propellers themselves operating in tunnels in the vessel's stern.

In France, on the other hand, we have the case of a self-propelling, bow-well bucket dredger to which the whole of the power is Diesel electrically applied. There is in short no unanimity in thought on the best way of Diesel powering such ships; indeed the technique of the Diesel dredger itself is young, about twenty years old. The countries who view it with favour, graded by numerical output, appear to be roughly the United States, the Argentine Republic, France, Holland and Great Britain. This order is to some extent comparable with the respective average fuel costs in peace time. This is not, however, necessarily a governing factor. Again speaking numerically, Holland has probably done more than any other European country to built Diesel-electric dredgers, but these have gone mainly to South America for the big body of opinion in Holland still seems to favour steam drive. Great Britain has made virtually no strides at all in Diesel or Diesel-electric dredging. The Port of Liverpool which is an obvious location for such ship types, shows no sign of breaking with tradition. Here, too, fuel cost has to be taken into consideration. But with the gradual spread of oil engine drive to coaster types, it is a matter of decreasing importance. It should be mentioned, moreover, that just before the outbreak of the present conflict the Corporation of Southend did order a Diesel-electric grab dredge of unique design. Then, too there are many small dipper and drag line dredgers with Diesel drive in use in England. These, however, are not electric.

It is therefore to America that we must in the main turn for examples of up-to-date Diesel dredging technique and in particular to the work of the Army Corps of Engineers which is charged with the maintenance of an efficient basis of all harbour entrances. The engineers have whole-heartedly espoused the

*Conclusion of the article on page 197 of the June issue.

The Use of Oil Engine Power for Dock and Harbour Work—continued

cause of Diesel drive. In fact, since the big ships of A. Mackenzie class were completed some sixteen years ago, there has, with one notable exception, in which turbo-electric drive was employed, been no turning away from the oil engine. America was early to see the possibility of oil engine economy and ready at the same time to admit that electricity was an ideal, if expensive and perhaps initially " tricky " method of transferring and transforming the power required for the various dredger duties. It is interesting, therefore, now to remark briefly on the characteristics of some of the examples available, first of all in America, and later upon those in other countries.

The U.S. Army Engineer's dredger " Pacific," built as a sea-going suction hopper unit is an interesting case in point with a flexible coupling, the normal speed of the engine and pump being 230 to 250 revolutions per minute. The pump can deliver dredged materials through 3,000-ft. of pipe line with a 25-ft. lift and under average conditions will pump from 1,500 to 2,000 cubic yds. of sand and gravel per hour. Abaft the main pump Diesel is a compartment containing two main Diesel generator sets of 650 h.p., each direct connected to two D.C. generators mounted on the same shaft, one of them being of 400 kw. capacity and the other of 200 kw. This unusual disposition of generators is for the purpose of giving a very sensible arrangement whereby they may be used for propulsion or for simultaneous operation of the large cutter head motor, heavy duty winches and miscellaneous auxiliaries.

EXAMPLES OF DIESEL OPERATED DREDGERS.

COUNTRY / Type	PROPULSION Drive	PROPULSION Load	DREDGING Drive	DREDGING Type	SIZE OF SHIP	OTHER DETAILS
1. U.S.A. Suction Hopper Self Prop.	Direct Twin Screw	2,000 h.p. 250 r.p.m.	Direct Twin 650 h.p. Diesel	22in. Pumps Centrifugal	2,5000 cu. yds. Capacity	400 kw. Diesel Generator for Auxiliary Duties
2. U.S.A. Suction Hopper Self Prop. Shallow Draft	Geared Twin Screw	800 h.p. 450 r.p.m. 130 r.p.m. Screw	Electric 340 h.p. 240 Volts. D.C.	18in. Pump Centrifugal	500 cu. yds. Capacity max.	275 kw. Diesel Generator between main engines. 10ft. 10in. max. draft
3. CHINA* Cutter Suction Non. Self Prop.	—	—	Direct 150 h.p. Diesel National	12in. Pump 470 r.p.m.	56ft. x 18ft. x 7ft.. 3in. Hull 4ft. draft.	800ft. length of pipe line. 65 h.p. cutter diesel 400 r.p.m.
4. FRANCE Bow Well Bucket Self Prop.	Diesel Electric	660 h.p. 1,200 r.p.m. 170 r.p.m. Screw	Electric D.C. 900 h.p. Sulzer Diesel	Buckets and Arm Capstans	172ft. x 33.3ft. x 13.3ft.	Dredges to 50ft. depth. " Pilot House " Control
5. CANADA Cutter Suction Non. Self Prop.	—	—	Diesel Electric	1,500 h.p. 500 r.p.m. 2,200 V.	125ft. x 40ft. x 8.5ft.	Converted from steam. Discharged against 100 lbs. through 20in. pipe up to 6,000ft. long.

*This example is not, perhaps, typical as regards duty, but is chosen as a British engine application.

direct Diesel drive for the propellers and Diesel-electric equipment for the rest of the ship. The vessl is 180-ft. 3-in. overall, with a beam of 38-ft., a depth amidships of 14-ft., a draft fully loaded mean of 10-ft. 10-in. The displacement loaded is 1,600 tons; the loaded speed is just under 10 knots. She has a fuel tank capacity of 300 tons which confer on her a radius of operation of just over 2,000 nautical miles. The load draft calculated above is for 500 cubic yds. of sand in the hoppers and a full load of fuel, water and stores on board. The propelling units are 8-cyl. direct reversible, medium speed Winton Diesels each developing 400 s.h.p. at 450 r.p.m. They are connected to the propeller shaft through hydraulic couplings and mechanical reduction gears and when the engines are turning at 450 revolutions the screws run at 130 revolutions. Propellers of this kind demand special design because they must deliver strong towing effect at customary dredging speed and efficient propulsive efficiency at full loaded speed. It is interesting to note that rubber bearings are installed in the stern tubes and " A " brackets or struts. There is a single 18-in. suction dredging pump driven by a directly connected D.C. 240-volt General Electric motor with a normal rating of 340 h.p. and with an over load capacity enabling it to run at 425 h.p. indefinitely without over-heating. The pump ranges from 210 to 250 revolutions and the motor takes its current from a 275 kw. 240-volt General Electric D.C. generator which in turn is directly connected to a 400 h.p. 8-cyl. Winton Diesel engine. Electricity is employed for the whole of the auxiliary arrangements on this vessel.

And now for an example of what we should call a suction reclamation dredger. One of two Diesel-electric ships built for the U.S. Engineers, it is a 20-in. pipe line unit by the Dravo Construction Co., of Pittsburg. The huil of each vessel is built of wrought iron, an unusual feature, and has a length of 230-ft. with a beam of 48-ft. and a depth of hull of 8½-ft., with tunnels built in the after body to accommodate twin propellers. The usual long structure is built up on the deck and there are two large " spuds " at the aft end. The suction arm is at the forward end with its cutter head. The dredging pump and its engines are in a well on the centre line of the hull approximately 54-ft. long and 17-ft. wide. The pump engine is a Nordberg 6-cyl. 1,000 h.p. Diesel and is direct connected to the pump by

Two propelling motors of 500 h.p. each are direct connected to 6-in. shafts for the propellers. The propellers themselves have a 6-ft. 3-in. diameter and a pitch of 4-ft. 7-in. adjustable between the limits of 4-ft. 2-in. and 5-ft., rubber bearings in the stern tubes and struts are again employed. It is obvious that the electrical requirements in a ship of this kind are very heavy and most American dredgers are lavishly equipped. The two vessels in question have been on service over three years in the St. Paul and Rock Island district being used in maintenance and improvement of the Mississippi River in those districts.

Yet another variation of the same theme is to be found in the dredge " Chester Harding," a sea-going suction hopper type of unusual design with a water line length of 300-ft. and a beam moulded of 66-ft. and a draft loaded of 20-ft. 2-in., her loaded displacement being 7,523 tons. Two 650 brake h.p. Diesels mounted thwartships drive two 22-in. centrifugal dredge pumps, and two main propelling Diesels, each of 1,000 h.p. are direct coupled to screws for propulsion. There is also a 400 kw. Diesel generator for driving the whole of the auxiliary equipment on the ship. The " Chester Harding " then, is a vessel in which principal reliance is placed upon direct coupled Diesels and electricity is employed for the auxiliary purposes although it should be emphasised that the term " auxiliary " is conventional rather than functional.

The existence of a suction hopper dredger with 3,700 Diesel horse power is surely an indication of the favour with which the oil engine is regarded. The ship in question was the " Victor Guilloux," which at the time of her completion in 1934 claimed to be the biggest self-propelled ship of her class. She was actually a self-propelled suction reclamation type and was built for service in the Port of Rouen, design being such that the dredged material could be loaded on board and afterwards discharged on land through piping about 3,000-ft. in length. Normal discharge into hoppers alongside was also possible. There were two main engines coupled to two main dredge pumps at the forward end and to the propeller shafts at the aft end, arrangements being made for the disconnection of one or the other as required. Diesel electric operation was used in a more limited sense than in the other vessels discussed for

(Concluded on page 290)

The Dragline Excavator

By WILLIAM BARNES, M.I.Mech.E.

(Concluded from page 262)

PART II.—APPLICATIONS.

Canal Excavation: Working Costs

The accompanying table gives details of costs for the excavation of a canal from sandy clay, using a dragline with a 1¼ cubic yard bucket, sidecasting, and working two shifts per day (96 hours per week). The average output was 137 cubic yards per hour (13,152 cubic yards per week):

Fig. 6. Excavating Stratified Material: A "Walking" Dragline on the Albert Canal, Belgium.

TABLE

Item.	Cost per week: £ s. d.	Unit costs.
Labour:		
Two operators at 2s. per hour, each	9 12 0	
Two boys at 9d. per hour, each	3 12 0	
Fuel:		
Diesel-oil: 319 gallons at 6d. per gallon	7 19 6	0.15d. per cubic yard (41 cubic yards per gallon).
Lubrication, etc.:		
Engine oil: 16½ gallons at 3s. per gallon	2 9 6	0.05d. per cubic yard.
Machine oil: 2 gallons at 2s. 6d. per gallon	0 5 0	
Grease: 33lbs. at 3¼d. per lb.	0 9 0	
Cotton Waste	0 0 10	
Repairs and maintenance (excluding ropes)	5 10 0	0.1d. per cubic yard.
Ropes: derricking rope every 4 months; hoist rope every 2 months; drag rope every 4 weeks	3 9 0	
Total	£33 6 10	

Total cost per cubic yard (excluding capital charges): 0.61d.

A "Walking" Dragline on the Albert Canal, Belgium.

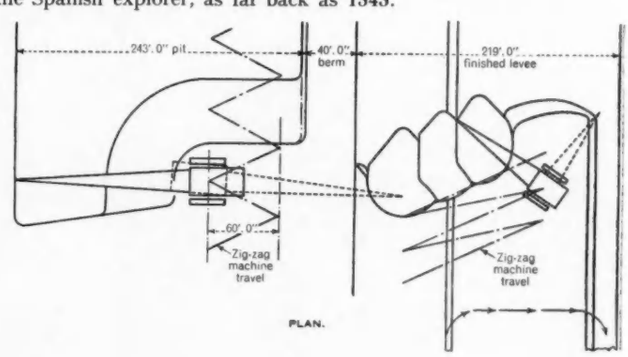
Fig. 6 shows a "walking" dragline at work on the Briegden-Gellick section of the Albert Canal, which runs from Antwerp to Liège. The Albert Canal was commenced in 1930 and was to have been opened in 1939. It takes barges up to 2,000 tons capacity, cost about £100,000,000, and involved the excavation of about 100,000,000 cubic yards of material. The canal is approximately 78 miles long (the old one was 96.3 miles long) and now runs entirely through Belgian territory. The dragline, fitted with a 6 cubic yard bucket on a boom 135-ft. long, is shown working in a deep wide cutting near Lanaeken.

The upper portion of the material in this cutting consisted of clay and the lower portion of gravel. The clay and gravel were excavated separately by the dragline. The former was used to construct the banks on the lower levels of the canal and the latter as an aggregate for approximately 80,000 cubic yards of concrete necessary for lining the sides of the canal. It is a useful illustration of the ability of a dragline to excavate, separately, layers or benches of different kinds of material. The machine worked, almost continuously, two or three shifts (18-24 hours per day), for 4-5 years and excavated about 5,500,000 cubic yards at the average rate of approximately 100,000 cubic yards per month. The machine, powered by a 280 horse-power Diesel engine, weighed about 300 tons. The average output was approximately 240 cubic yards per hour, and the Diesel oil consumption was approximately 6.5 gallons per hour (about 37 cubic yards per gallon).

*Extracts from Paper read before the Institution of Civil Engineers, on February 20th, 1940, and reprinted by permission from the Institution Journal

Levee Construction on the Mississippi River

The biggest excavation jobs in the world, as far as draglines are concerned, are the flood-control schemes in the Mississippi basin. Commenced over 200 years ago, by hand labour, they have developed in recent years to highly mechanised schemes. Floods alongside this famous river were recorded by De Soto, the Spanish explorer, as far back as 1543.



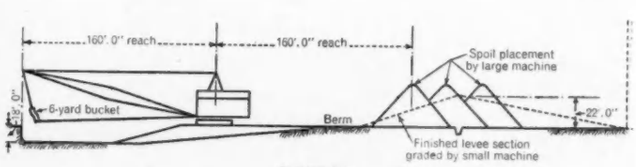


Fig. 7. Building a Lever.

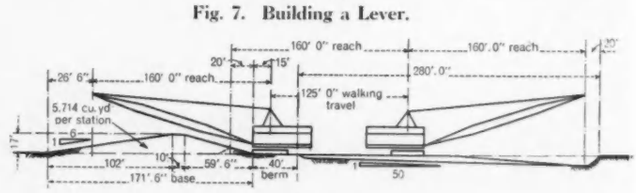


Fig. 8

The Dragline Excavator—continued

The first levee was constructed in 1717, and the Governor of New Orleans boasted that it was a mile long and 18-ft. wide. Local construction, financed by the inhabitants of this district, developed from that date until, by 1812, embankments had been built on both banks for a distance of 340 miles. Federal operations date from 1820 and from then have proceeded with increasing momentum. The Mississippi River Commission was created in 1879 and, in 1881, $1,000,000 was granted for this work. In 1927 the greatest flood on record occurred and in 1928 $325,000,000 was authorised by Congress for levee construction. In 1935 $272,000,000 was added to the amount still unexpended under the 1928 Act, and a further grant of $40,000,000 was made in 1937-38.

Since 1928 about 650,000,000 cubic yards of material have been placed in the levees over an aggregate length of about 2,000 miles.

Commencing about 1912, draglines, mostly of the " walking " type, have been chiefly used for this work because of their very low bearing pressure on the ground and their ability to sidestep and zigzag so as to obtain the necessary digging width and to dump the wide levees which have been, and are still being, constructed. Approximately one hundred excavators of this type have been, or are being, used upon the various schemes.

Because of the heavy cost of coal for steam machines and the difficulty of obtaining suitable water for the boilers, Diesel engines, even upon the largest size, are used almost exclusively.

Generally speaking the digging is very easy and, as dumping radius is of great importance, light steel or aluminium alloy booms are largely used in conjunction with lightweight buckets.

The contract price ranges from a minimum of 8 cents to a maximum of 24 cents per cubic yard.

The levees are built up of material excavated from borrow pits adjacent to, and parallel to, the levees. Several methods are employed to build these big levees, and the rehandling of the material is reduced as far as possible. Two of the methods are shown in Figs. 7 and 8.

Fig. 9. The " All-American " Canal.

In Fig. 7 the finished levee is 219-ft. across the base and 22-ft. high; the necessary material is obtained from a borrow pit 243-ft. wide and 18-ft. deep, tapering off to practically zero near the berm. Two draglines are employed, a large one with a 160-ft. boom and a 6 cubic yard bucket for digging the material, and a smaller one, on the dump side, for taking off the peaks and spreading the material as nearly as possible to the required section. The final levelling is carried out by hand labour. The three-peaked section on the levee side is obtained by zigzagging the big machine as shown in the plan.

In Fig. 8, showing a levee 171-ft. 6-in. across the base, one dragline only is employed and it is travelled in a series of steps or stages over a distance of 125-ft. It is only necessary to spread some of the material on the far side of th levee, shown by the dimensions 26-ft. 6-in., which is beyond the normal dumping reach of the machine.

Building a Levee

The table annexed gives representative outputs from " walking " draglines with varying boom-lengths and bucket capacities working on the Mississippi levees.

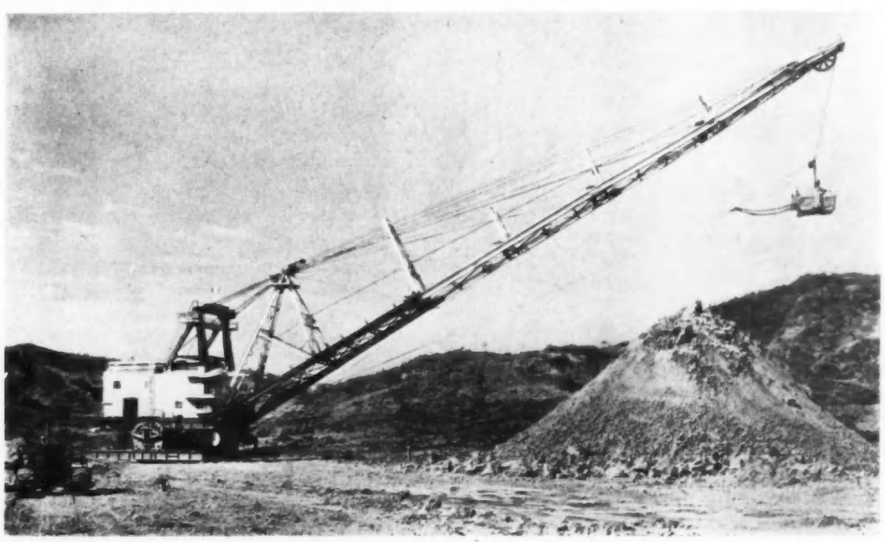


Fig. 10. The World's Largest Dragline.

It will be noticed that in the smaller machines with shorter boom-lengths the average output per cubic yard of bucket capacity is greater, because of the shorter boom-lengths and the consequent shorter distance that the material is transported or dumped.

The Dragline Excavator—continued

TABLE

Length of boom: feet.	Capacity of bucket: cubic yards	Average hourly output (three 8-hour shifts per day, 7 days per week): cubic yards.	Hourly average output per cubic yard of bucket-capacity: cubic yards.	Remarks.
150	8	350	43	Average monthly output: 245,000 cubic yards.
150	7	280	40	Average monthly output: 195,000 cubic yards.
150	5½	240	43	Maximum output in a month: 285,000 cubic yards (an average of 400 cubic yards per hour).
120	6	390	65	—
120	6	450	75	—

The " All-American " Canal

Fig. 9 is an aerial view of a portion of the " All-American " canal* in California, which involved the excavation of about 14,000,000 cubic yards of material. The main canal is 80 miles long with a branch canal 130 miles long. The east section of the canal is 160-ft. wide at the bottom and 22-ft. deep, with slopes of 1 in 2. The deepest cut through the " sandhill area " was 115-ft. deep. The total cost was about £9,000,000 and the scheme will irrigate about 1,000,000 acres of land by means of water from the Colorado River.

The job was placed out to contractors, who tendered approximately 6d. per cubic yard for the dirt, mainly sand and silt, and from 2s. to 5s. per cubic yard for a quantity of rock which was encountered.

Seven Diesel-driven " walking " draglines were employed, with buckets of 12, 6 and 3 cubic yards capacity, together with a number of small draglines with 2 cubic yard buckets.

One of the 12 cubic yard draglines working 24 hours per day, excavated the enormous quantity of 5,501,000 cubic yards in 12 months.

*" The All-American Canal," The Engineer, Vol. clxvii. (1939) p. 696 (9th June) and p. 728 (16th June).

The portion of the canal shown was excavated in two cuts, the material being dumped on each side to form the banks. The method of working is clearly shown in Fig. 9.

In some portions of the canal cemented gravel was encountered and excavation proved very difficult. Blasting was at first resorted to, but it entailed too much delay, and a cast-steel rooter, weighing over 10 tons, was substituted for the dragline bucket.

The rooter was dragged through the compact gravel and when sufficient material had been loosened it was removed and the digging was continued with a 12 cubic yard bucket.

The World's Largest Dragline

In conclusion, it may be interesting to give a few particulars of the largest dragline so far constructed. The " walking " type is shown in Fig. 10, but the same size of machine is also supplied with caterpillar mounting. The following is a brief specification:

Length of boom: feet	200	225	250
Capacity of bucket: cubic yards	15	12	10
Maximum dumping radius: feet	214	240	265

Working weight	Approximately 1,000 tons.
Electric drive	Ward-Leonard control.
Digging motors	500 brake horsepower.
Diameter of base on " walker "	45 feet.
Bearing area	1,590 square feet.
Bearing area with caterpillar mounting	384 square feet.
Approximate time for 1 cycle of operations	65-75 seconds.
Output, depending on material and working conditions	350-650 cubic yards per hour with 15-cubic-yard bucket.
Current consumption	0.5-0.75 kilowatt-hour per cubic yard.

Fig. 10 clearly shows the " walking " device, the operator's cabin, the large superstructure, the long boom, and the wide-spread feet.

Acknowledgments.

The Author thanks a number of excavator manufacturers for their assistance in supplying information or photographs, or both.

The Foreign Trade Zone, or Free Port Area of New York.

*Description of a Notable American Enterprise**

By HON. EMANUEL CELLER.

Come with me on a visit to the free port of Stapleton, Staten Island, the only enterprise of its kind in the United States and one which is rapidly justifying the optimistic expectations of its sponsors and others who waged a long and unceasing fight for its establishment.

Before we pass through its gates, however, we should pause and recall that the free port—or the foreign-trade zone as it is known officially—has been in business less than 3 years. For half of that period it was operated by a private corporation, the New York Foreign Trade Zone Operators, Inc., which functions under a 20-year contract granted by the Board of Estimate.

We have often heard of the free port of Copenhagen, the free port of Danzig, and many others. Now we have the free port of New York—thanks to my foreign-trade-zone bill, which became law in 1934. I fought for the passage of that bill for many years. The fine record already established for the free port of New York is ample reward for my efforts. Tribute must be paid to Mayor LaGuardia and his able commissioner of docks, Mr. John McKenzie, for their unstinting labours in making the experiment an outstanding success. I would be remiss if I did not also pay tribute to the Honourable Newbold Morris, president of the New York City Council, who has rendered yeoman service to the building up of the free port.

At the outset, let is be understood that a free port has nothing to do with free trade. It is a zone limited generally to foreign commerce and trade. It is a policed, segregated area on Staten Island, where goods, imported free of duty and customs supervision, may be graded, sorted, manipulated, mixed, with domestic material, repacked, reclassified, warehoused, stored, or labelled. Such goods are subject to duty only when released from the zone into domestic commerce. If such goods are trans-shipped to foreign territory, no duty is imposed. As far as customs are concerned, the zone is foreign territory.

At present the free port includes four of the piers constructed during the administration of the late Mayor John F. Hylan at the conclusion of the World War two decades ago. For many years these piers were known as white elephants; they represented a dead investment on which the city realised virtually no return.

Would that the late Mr. Hylan could accompany us as we walk into the free port to-day and observe the amazing transformation that has come over these erstwhile white elephant piers during the past 18 or 19 months. I have made many visits to Stapleton since the foreign-trade zone was opened. I am agreeably astonished at the volume of industry and the extent of activities now centred there.

When President Roosevelt signed my bill he expressed the hope to me that four free ports might be set up—two on the Atlantic Coast and one on the Gulf of Mexico and one on the Pacific Coast. The New York free port is now well established. It is hoped the three other free ports yet to be established will follow the successful example of New York's zone.

We see at the New York free port such diversified commodities as hides and silver-fox furs, tobacco from Sumatra, brandy from South Africa, tungsten ore from China, corned beef from the Argentine, and rugs from distant Iran. We see cognacs and champagnes from the vineyards of France, whisky from the distilleries of Ireland, linoleum from Italy, and sisal fibre from Yucatan. Here are untold thousands of pounds of nuts from the jungles of Brazil, delicate watch parts from Switzerland. We also see the strong room in which is kept a valuable shipment of diamonds from the Netherlands.

All around us is the bustle of men at work loading and unloading cargoes between steamships and the docks. Groups of girls are busy attaching keys and labels to cans of cooked meats. The most spectacular sight in the zone is the thousands of boxes, crates, and lift vans containing the furniture and personal effects of central European refugees fleeing the terrors of dictatorships. It is a vivid yet pathetic commentary on the European situation. What a human and vital need is thus served by the zone. In addition to its value as a halfway house of commerce, the free port, we see, is an enterprise that provides employment to many of our citizens.

Just how is the free port used by shippers, importers, and exporters? Let us examine this cargo of South American

*Extracted from a recent issue of "Shipping Register and North American Ports."

The Foreign Trade Zone, or Free Port Area of New York—continued

meat. The firm which brings these meats to the trade zone began with a shipment of 17 tons. It now ships approximately 350 tons through the zone each month. These shipments have brought substantial business to manufacturers of the cardboard cartons in which the cans are packed for distribution among wholesalers throughout the United States. Printers and lithographers turn out the millions of labels that are pasted on the cans before they are packed, and wire manufacturers furnish the keys which are attached to the metal containers. All this business, of course, goes to American firms. The corned beef operation at the free port, consequently, has resulted not only in employment for men and women at the zone but in new purchases of manufactured American products.

The silver-fox furs and the sheepskin hides we have seen represent an important development of American commerce. They indicate that this country is at least regaining one world market it lost some years ago and is winning another world market which in the past has always been located in Europe.

For many years the Port of New York had been the hide market of the world. It lost this market to Holland; hides from South America and from the Far East were shipped to Holland instead of to New York, and buyers from the world around were compelled to travel to that country to make their extensive purchases. The free port is bringing the hide market back to this city. The facilities of the foreign trade zone were the magnet that induced the important industry to return to its former abode.

The fur market of the world was long established in Leipzig, Germany. Some years ago it was transferred to Leningrad, Russia, and about 6 months ago it was shifted to London. Fur buyers travelled from every country to the capital of Britain to attend the auction sales on silver foxes and other costly skins. Only recently this market was moved across the Atlantic to the foreign-trade zone on Staten Island. Auctions will be held at the zone from time to time and the foreign buyers will henceforth come to New York to purchase their furs instead of going to Europe.

The experience of the importers of Brazil nuts demonstrates the fashion in which the free port is proving its worth as a money saver to persons and corporations engaged in foreign commerce. A year ago one of our largest importers of this product shipped in bulk some 3,000 tons of Brazil nuts which were to be cured at the zone. The nuts arrived in April and remained in the cooled space until October 1st. By this time they showed a shrinkage of something like 15 to 20 per cent. which the importer saved in duty, as he paid the Government duty on the weights discharged into customs territory and ready for marketing, not on the weights which were brought into the zone.

So successful was this importer's first experience that this year the tonnage was increased to 5,000 tons or 10,000,000 pounds. Here again the shipments bring wages to Staten Island residents, since, besides the longshoremen and warehousemen who are required to move the cargoes, it usually takes about 150 girls to go through an entire shipment to select and grade these Brazil nuts before they can be marketed.

An experiment is at this moment being tried out at the free port by a large organisation which has perfected a machine for shelling cashew nuts. If this test shows the satisfactory results that are anticipated the shelled nuts will be put up in packages and the hulls sent to a processing plant where the shells will be crushed and the oil which they contain will be used for various purposes. Here again, additional labour will be called for, all new to the United States.

The South American brandy was sent to the foreign-trade zone direct from South Africa in order that it might be reduced to 86 proof, which is the standard strength of brandy, and bottled. The bottles, of course, are American. The labour is also American.

Wines of old vintage are sent to the foreign-trade zone from Europe, and liquors, cognacs, and champagnes are shipped here for ageing.

Especially to the importer of Persian rugs is the foreign-trade zone a useful point of shipment. Persian rugs, the genuine article, are very expensive. When they are bought the importer in reality does not know the condition of the rugs upon their arrival in this country. However, in the foreign-trade zone and nowhere else in the entire United States, he is permitted to open up the bales and examine their contents. If the rugs are flawless they are brought into customs territory and sent out to the retail stores. Should they be marred in any way they are sent back to the country of origin.

The same situation applies to the importation of linoleum from Italy. Let me cite a recent case in which one of the largest importers of this floor covering suffered a very serious financial loss due to the fact that the shipment was sent to a warehouse and was not examined upon arrival here. After this particular lot had been sold at San Francisco and the rolls opened, it was found that the print had run. The entire shipment was refused and the importer had no redress because in the warehouse where they were stored he did not have the privilege of examining the goods, and, as a result, there was nothing left for him to do but take the loss. When the linoleum is stored at the free port the importer may examine it at any time and withhold payment on his shipments until he is satisfied that they are in perfect condition. Only the free port makes such transactions possible.

A shipment of diamonds valued at nearly $200,000 was sent to the foreign-trade zone recently by airplane parcel post. The 8,000 stones comprising the shipment were sorted and graded, duty was paid on the pieces which were entered into the United States, and the balance was exported to Latin-American countries. During the time that these diamonds were in the zone the customary customs guards were on hand and 6 special watchmen were assigned as a precaution against anything happening to this shipment. Of course, guards and watchmen protect all commodities at the zone, but in this case the operators had to take special precautionary measures because of the value of the jewels.

The watch trade has found employment at the zone through the importation of Swiss movements which are fitted in cases of American production. The completed watch is then sent into the United States after payment of duty.

Motion-picture films come to the zone from all over the world. Here they are clipped and then re-exported to countries demanding the various series of pictures that are catalogued. In this way the duty is saved.

Recently the United States Government closed contracts for the very valuable tungsten ore. This ore is now being concentrated in the foreign trade zone pending orders for shipment to points specified by the Government.

At the present moment there is more than $1,500,000 worth of Sumatra tobacco at the zone. It is stored in specially constructed rooms for one of the largest cigar manufacturers in the United States.

The free port serves as an important trans-shipment point. This fact is attested by the thousands of tons of such commodities as sisal, or ixtle, and soybeans, which arrive here annually for trans-shipment to European countries. This operation alone requires the services of approximately 250 men for many days at a stretch in the unloading and loading of the ships which arrive directly in the zone.

There is one activity at the free port which is not widely known. This is the storage, duty-free, of historic and valuable books from universities in the war area of Shanghai, China, which have been sent here for safe keeping. They will be returned to the shelves from which they were plucked after the hostilities in the Far East are ended.

In our brief tour of the foreign-trade zone we have seen enough of its varied activities to warrant our belief that the zone has proved its worth as a stimulant to foreign and domestic commerce. One marvels at the thought that not 2 or 3 years ago these piers were a dreary void, empty of cargoes and of men, while to-day they accommodate shipments to the value of approximately $15,000,000. During the month of October, 1939, $32,800 has been paid out in wages to approximately 908 men and women. The zone has stimulated not only the commercial life of our nation and of many nations in other parts of the world, but also the trade of the neighbourhood shopkeepers on Staten Island and elsewhere in our city, who have benefited by the added patronage brought about through the increased employment of local residents.

Panama Canal Traffic

The following table shows the ocean-going commercial traffic passing through the Canal each month for the twelve months ended June 30th, 1940, with comparative figures for the twelve previous months. Ocean-going commercial traffic includes only tolls-paying vessels of 300 tons net, or over, Panama Canal measurement:—

	No. of vessels		Tons of cargo	
Monthly	1939-40	1938-39	1939-40	1938-39
July	485	429	2,317,697	2,025,660
August	490	468	2,385,039	2,171,674
September	457	438	2,445,700	1,998,464
October	458	494	2,386,314	2,359,673
November	489	505	2,472,503	2,223,830
December	489	509	2,361,176	2,374,395
January	466	525	2,337,943	2,393,360
February	402	501	2,123,574	2,206,963
March	470	553	2,279,432	2,664,068
April	376	496	2,081,483	2,472,504
May	419	506	2,319,372	2,538,949
June	369	479	1,788,783	2,437,087
	5,370	5,903	27,299,016	27,866,627

The Use of Oil Engine Power for Dock and Harbour Work

(Concluded from page 285)

auxiliary purposes, the Diesel generator sets being arranged aft between tne two main engines. The " Victor Guilloux " had a hopper capacity of 1,000 cubic metres on a draft of just over 15-ft. in fully-loaded conditions, and the ship takes her place as one of the most noteworthy examples of Diesel propulsion yet completed. France has always been liberal in her attitude towards the use of oil engines in these dredgers, and in particular has looked with favour on the use of Diesel electric drive for the big ships responsible for maintaining in a shipworthy condition the rivers emptying into the Bay of Biscay.

One such example is the " Pierre Lefort," owned by the Bordeaux Port Authority and having three Diesel generators, each of 970 kw. output, each operated by a M.A.N. 4-cycle single-acting airless injection engine at 157 revs. This vessel is of suction hopper type.

Probably the most interesting of all Diesel dredgers yet built is, however, the " Dieppe IV.", a ship of 172-ft. length, a beam of 33½-ft. and a depth of 13½-ft., with a displacement of 1,200 tons, capable of dredging to a depth of 50-ft. She is a bow well self-propelling non-hopper bucket dredger, and for propelling the vessel as well as for driving the dredging mechanism an airless injection, 7-cyl., 2-cycle, 900 h.p. Sulzer Diesel built at the Port of Havre has been installed. The engine is direct coupled to a double Diesel generator with a nominal output of 2 x 275 kw. It also drives an exciter of 40 kws. at 20-volts mounted on to the end of the shaft. The generator voltage can be adapted between 0 and 220-volts. The current generated is led either to the two propulsion motors aft of the vessel or to the motor driving the dredging mechanism or to the dredge winches and other auxiliaries. Each of the two propellers is driven by a 330 h.p. electric motor through gearing which reduces the speed from 1,200 to 170 revs. There is also an auxiliary of 50 kw. driven by a 3-cyl. Sulzer 2-cycle Diesel at 80 h.p. which operates the various auxiliary parts when the main engines are running. The winches are fitted with electric motors of 45 to 100 h.p. and are equipped with semi-automatic drive. All the switch gear required for the propelling plant is arranged in the wheelhouse above and abaft the dredger ladder, whilst the switch gear for the dredging apparatus is on the control platform thus enabling the man in charge to control the speed of the dredging apparatus.

Tests on this dredger were carried out at Le Havre and Dieppe. It was possible to begin dredging in less than five minutes after the crew had come on board. Although the specification called for the removal of 17,650 cubic ft. of mud, sand and gravel per hour, 23,100 cubic ft. was the figure realised at a depth of 44-ft. 6-in., while in hard soil, gravel and chalk deposit, corresponding figures were 12,350 and 17,050 at 42-ft. 6-in. A Diesel-electric bucket dredger somewhat similar in size, but a non-self-propelling type was delivered in 1930 to the Harbour at Antwerp, by Messrs. Smit, near Rotterdam. This vessel had a length of 167-ft. 4-in., a beam of 29-ft. 6-in. with a maximum dredging depth of 49-ft. 3-in. and a draft of 6-ft. 3-in. A Diesel engine of 460 b.h.p. supplied the electric power plant. It is believed that in this, as in other ports, as a result of the experience gained with Diesel-electric bucket dredgers, further similar contracts were contemplated as it was felt that the oil engine had established itself thoroughly.

Aerial Attacks on German-occupied Ports

A number of German-occupied ports on the Netherlands, Belgian and French littorals have been attacked and damaged by squadrons of the British Royal Air Force. One such attack launched on Saturday night, 14th September, was particularly heavy. The Air Ministry's report on the episode is as follows:

One of the night's most devastating onslaughts was made on Antwerp, which an earlier would-be invader of this country described as " a dagger pointed to the heart of England." Havoc was caused in the vast network of docks, warehouses and petrol sheds on the banks of the Scheldt and the shipping lying in the stream, as large forces of bombers dropped nearly 40 tons of high explosive bombs and over 1,000 incendiaries, in an attack lasting from 11 o'clock until 1.30 a.m. on Sunday.

The general report of the raid states: " Every sortie reported hits in the dock area. Both the eastern and western basins were repeatedly bombed from all directions. A warehouse, which from the violence of the explosion that followed must have contained explosives, was wrecked. Barges at the mouth of the docks and shipping alongside the basins were successfully bombed. One ship was seen to be on fire, and a big blaze was started on the north side of the basin. Another fire on the south side of the basin was believed from its appearance to be an oil fire."

Port Emergency Committees

Review of Procedure at Instance of Minister of Transport

The following statement has been issued by the Ministry of Transport:—

The emergency committees set up by the Minister of Transport to act as his representatives in more than 40 principal ports of Great Britain have, since the war began, adapted themselves successfully to the changing circumstances, and established friendly contacts with other emergency organisations concerned with the passage through the ports of particular types of cargo.

They have now been asked by the Minister to review, and where possible improve, the existing machinery in the light of nearly 12 months' experience, supplemented by certain views expressed in reports by Mr. Frank Pick, who at the request of the Minister recently visited several of the chief ports. In particular the Minister has indicated the need for action on the following lines.

Port emergency committees should take the widest view of their powers to secure the quick turn-round of ships and the rapid clearance of ports. Consideration should be given to the setting up in each port of an executive committee of the port emergency committee to meet weekly and even daily during an emergency, to maintain close contact with the local officers of the various Government Departments concerned, such as the senior naval officer, the collector of customs, the port labour inspector, and the movement officers of the Ministries of Food and Supply.

The chief executive officer should be given reasonable discretion to act on behalf of the port emergency committee. In the event of a complete breakdown of communications the power of issuing instructions to groups of ports would be assumed on behalf of the Minister by divisional port controllers.

The purpose of the proposals is to ensure that machinery for dealing with emergency conditions is kept in a continually improving state of readiness, and that no bottle neck exists which would slow down either the flow of imported foodstuffs and raw materials, munitions, and finished goods, or the equally important flow of exports to pay for such supplies.

Each port emergency committee must naturally rely on the co-operation of traders, and the Minister would again urge the trading community to take all possible steps to pass their goods rapidly through the ports.

Otago Harbour Board, New Zealand

Excerpts from Chairman's Annual Report for the Year ended September 30th, 1939

Trade and Shipping

The total tonnage handled through the Port was 476,897 tons, a decrease of 7,901 tons or just over 1½ per cent. on last year's record tonnage. Notwithstanding this decrease, last year's trade ranks next after 1937-38, the previous best being 464,508 tons in 1924-25.

Imports declined by nearly 25,000 tons or 7 per cent., which was not surprising in view of all the circumstances. Exports on the other hand increased by just over 17,000 tons, equal to 13½ per cent. over last year. Higher overseas shipments, particularly in wool and fruit, account for 8,600 tons of the increase.

The tonnage of shipping arrivals at 1,059,195 tons (net) fell considerably below that of last year, which was a record at 1,225,830, the decline being 166,635 tons, equal to 13½ per cent. Although all classes, viz., oversea, inter-colonial and coastal tonnages decreased by approximately the same percentage, the decrease in the oversea section involved the largest tonnage, being over 108,000 tons below last year, and representing 21 vessels.

Revenue and Expenditure

In spite of the falling off in cargo and shipping, the actual receipts for the year were only some £3,500 below those of 1937-38.

The Income and Expenditure Account shows that, after providing for interest on loans, exchange, sinking fund contributions, loan repayments and depreciation of plant, there is an excess of income over expenditure of £5,418, as against £17,057 last year. The difference is largely accounted for by increased expenditure on repairs and renewals.

Works in Hand

The reconstruction of Birch Street Wharf was practically completed by the end of the year. This is one of the biggest works undertaken by the Board for some time, involving an expenditure of some £45,000. Another work which was nearing completion at the end of the year was the widening of the Leith Canal. Commenced in 1931, it was largely held up during the depression, but its progress since being recommenced in October, 1935, has been steady, and soon the Board will be free of the danger of flooding in its portion of the Canal.

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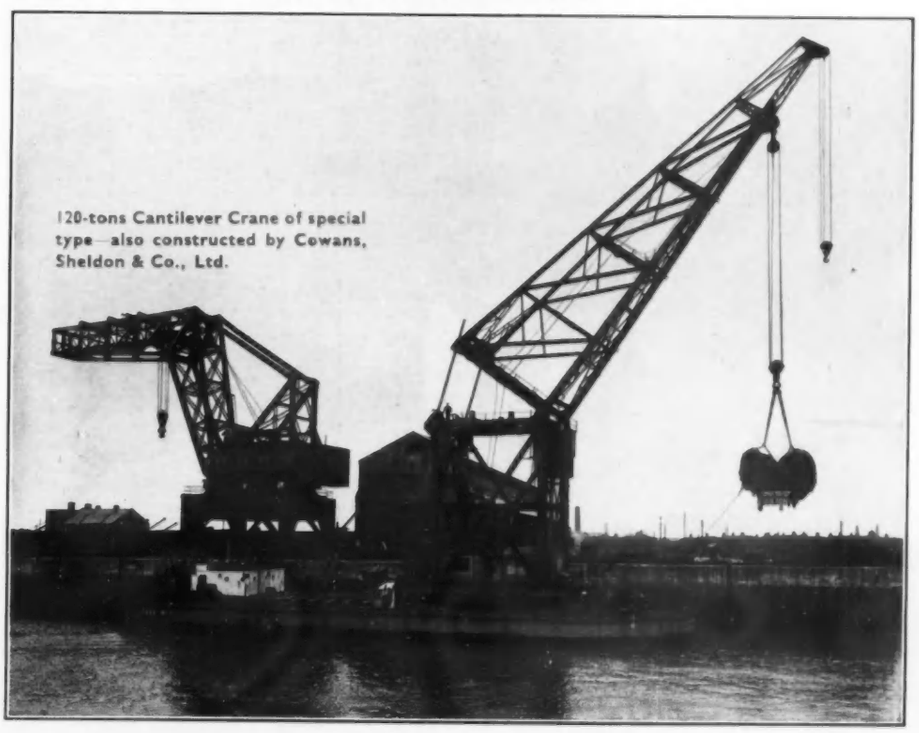

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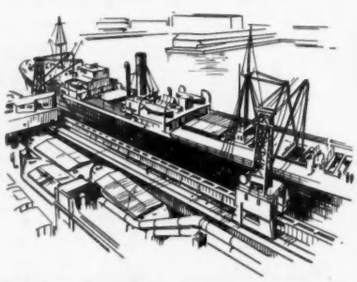

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